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VOL. 24. Ser. A. Part 7. pp. 409–472. JULY, 1936.

THE REVIEW OF APPLIED ENTOMOLOGY.

SERIES A: AGRICULTURAL.

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Annuaire de la Défense des Cultures. 1936. Med. 8vo, xvi+222 pp., illustr. Paris, " Publisil," 1936.

This year-book is divided into three parts. The first (*Documents techniques*) contains notes on plant pests and diseases in France and on methods and materials for their control, classified alphabetically, together with a short bibliography. The second part (*Documents administratifs et législatifs*) reviews official organisations concerned with pest control, and the legislation on the use of poisons and the sale of insecticides and fungicides [*cf. R.A.E.*, A **22** 511]. The third part (*Questions d'actualité*) contains papers including the following: Le doryphore de la pomme de terre, by B. Trouvelot (pp. 131–154), which gives a general account of the potato beetle [*Leptinotarsa decemlineata*, Say] and its control in France; Traitements courants des cultures fruitières, by F. Willaume (pp. 155–168), which comprises spray programmes for apples, pears, peaches, apricots, cherries, plums and walnuts; Quelques détails sur les traitements de printemps des arbres fruitiers, by P. H. Joessel (pp. 169–186); Les ennemis des agrumes [*Citrus*] en Algérie, by P. Lafond (pp. 187–190); La menace du pou de San José [*Aspidiotus perniciosus*, Comst.]; État actuel de la question en Europe, by A. Balachowsky (pp. 191–194) [*cf.* **22** 39]; and Essais de désinfection au trichlorethylène, des lentilles envahies par les bruches, by J. Verguin (pp. 195–197). Experiments on the fumigation of lentils infested with Bruchids described in the last paper showed that exposure to 1 fl. oz. trichlorethylene per 2 cu. ft. for 48 hours or more gave satisfactory control. Double this concentration retarded the germination of the seeds slightly. Although carbon bisulphide is three times as active, trichlorethylene has a pleasant odour and is not inflammable.

Moreau (L.) & Vinet (E.). **De l'amélioration et de la défense de la production fruitière.**—*Ann. Épiph. Phytogén.* N.S. **1** pp. 257–275, 3 refs. Paris, 1936.

An account is given of work, chiefly in 1935, on sprays against *Epidiaspis leperii*, Sign. (*piricola*, del G.), *Cydia* (*Carpocapsa*) *pomonella*, L., and the fungus, *Venturia pirina*, on pears in France. Observations are also recorded on the date of flowering of apple and pear trees and the fall of immature fruit in 1934.

Against *Epidiaspis*, sprays of 10 per cent. anthracene oil emulsion were applied at different dates to trees about 10–12 ft. high and 25 years old. The trees were examined about 2 months after the last application. The best results were given by 1 application on 12th March, which gave 85–98 per cent. control; 2 applications, in December and January, which gave 81–98 per cent. control; and 3 applications, in December, January and March, which gave complete control. None of the treatments caused scorching. Further examination of the trees during October showed a negligible infestation on those receiving 2 sprays or 1 late one, and none on those receiving 3 sprays.

Traps baited with cider dregs diluted with vinegar water and placed in the experimental area showed that peaks of emergence of *Cydia* occurred at the end of May and in mid-August in 1934, and at the end of May and in mid-July in 1935. In 1935, 26·3 per cent. of the fruit on unsprayed plots was infested by the larvae. Lead arsenate (at the rate of 1 lb. to 10 gals. Bordeaux mixture or lime-sulphur) gave average percentage controls of 99·1 when applied in spring and summer

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(on 8th and 24th April, 16th May, 3rd June, 11th and 23rd July), 85·9 when applied in summer only (3 sprays in June and July), and 55·8 when applied in spring only (8th and 24th April, 16th May). Dusts of barium fluosilicate applied in the summer (3rd June, 1st and 23rd July) gave poor control. At harvest (27th August) pears from each plot were analysed for arsenical residue. A residue of 1·6 mg. arsenic per kg. [0·0079 grains per lb.] was left by 6 applications of lead arsenate with Bordeaux mixture and also by 3 summer applications of lead arsenate with lime-sulphur ; and one of 0·75–1·35 mg. per kg. [0·0037–0·0067 grains per lb.] by 3 summer applications of lead arsenate with Bordeaux mixture. After washing with 2 per cent. hydrochloric acid and then water, the residue decreased to 0·35 mg. per kg. [0·0017 grains per lb.].

TROUVELOT (B.). **Le doryphore de la pomme de terre** (*Leptinotarsa decemlineata* **Say**) **en Amérique du Nord.**—*Ann. Épiph. Phytogén.* N.S. **1** pp. 277–336, 10 figs., 3 pp. refs. Paris, 1936.

The history, distribution and bionomics of the Colorado potato beetle (*Leptinotarsa decemlineata*, Say) in North America are discussed from the literature, and a concise account is given of the methods of control used there.

CHAPPELLIER (A.) & RAUCOURT (M.). **Remarques sur la dissémination du doryphore en 1935.**—*Ann. Epiph. Phytogén.* N.S. **1** pp. 337–340. Paris, 1936.

During 1935, infestation of potato by *Leptinotarsa decemlineata*, Say, spread into new areas in the centre and north-east of France, and increased in intensity in the slightly infested districts. For the first time on record in France, the beetles migrated in swarms, beginning about 8th–10th June, which was the first warm period following an exceptionally favourable autumn and a cold spring [*cf. R.A.E.*, A **23** 632]. The direction of flight is discussed ; it appeared to be towards the north-east. Swarms alighted in many localities in central France. One field under observation in Vienne was uninfested on 9th June, and on 10th June 5,000 beetles were taken from 1,000 sq. yds. and the field may have contained about 60,000. It is probable that beetles that appeared in Creuse had travelled 30 miles from the nearest serious source of infestation, Haute-Vienne, and that those that reached Cher, Allier and Nièvre had come from a distance of 90–124 miles. Infestation, spreading both by swarms and by the flight of single insects, reached nearly half the villages of Vosges although the nearest source of severe infestation was over 200 miles away, and during the year the beetles spread from Aube and Marne to north Ardennes, near the Belgian frontier [*cf.* **23** 739, 740], and were also seen near Maestricht on the Dutch frontier.

American Association of Economic Entomologists, Paper-Reading Session, 48th Annual Meeting, December 1935.—*J. econ. Ent.* **29** no. 1 pp. 1–65, Menasha, Wis., February 1936. [Recd. May 1936.]

Papers read at this Meeting included : Stabilizing Entomology, by L. A. Strong (pp. 1–6), in which the development of entomology in the United States since the first entomologist was appointed at the inauguration of the Department of Agriculture in 1862 is briefly traced.

The Crop Protection Institute, its Organization, Plan of Procedure and Work accomplished, by W. C. O'Kane (pp. 6–20), in which the achievements of this Institute over the 15 years of its existence, particularly in bringing industrialists into touch with research workers, are reviewed; The Commercial Entomologist, by J. C. Sanders (pp. 20–28), in which the increasing scope and value of work in commercial entomology is stressed; Teaching and Training in the Field of Entomology, by C. J. Drake (pp. 28–36), in which subjects considered essential in the training of entomologists are outlined; and (included in a Symposium of Orchard Sanitation under the direction of J. J. Davis) Measures other than Spraying for the Control of Orchard Insect Pests, by D. L. Van Dine (pp. 37–43, 13 refs.) in which results secured by various workers with such measures as clean cultivation, scraping, banding, screening of packing houses, etc., are discussed.

In Ovicidal and Scalicidal Properties of Solutions of Dinitro-o-cyclohexylphenol in Petroleum Oil, by J. F. Kagy and C. H. Richardson (pp. 52–61, 2 figs., 18 refs.), a report is given on the toxicity of this compound in the laboratory to *Aspidiotus perniciosus*, Comst., and to the eggs of *Lygaeus kalmii*, Stål. The compound is more specifically 2-4 dinitro-6-cyclohexylphenol, a yellowish-white crystalline substance, practically insoluble in water, soluble in petroleum oil [*cf. R.A.E.*, A **24** 433] and having a melting point of 106°C. The petroleum oil used in the experiments had the following specifications: specific gravity (20°C.) 0·8815; sulphonation value 82 per cent.; viscosity (Saybolt 100°F.) 99–100 seconds, and (140°F.) 53–54 seconds; boiling range 606–742°F. In the ovicide test, bugs that died immediately after hatching are included in the estimates of mortalities to furnish a measure of total effectiveness. The net mortalities [*cf. R.A.E.*, A **13** 331] for the oil emulsion without the dinitro compound were 6·6, 40·2 and 58·7 per cent. for dilutions of 1, 2 and 3 per cent. oil respectively, but 99–100 per cent. mortality was given by the same dilutions when the oil contained 6·67, 3 and 2 per cent. respectively of the dinitro compound. Similar results were obtained with *A. perniciosus*, 1 per cent. emulsions requiring 3 or 1·5 per cent. of the dinitro compound in the oil to give 100 or 98 per cent. net mortality. The dispersed oil globules that contain the compound in solution break from the aqueous phase directly on the surface of the egg or scale, and the amount of the compound in the outside phase is very small, having probably no effect on toxicity.

Other laboratory tests showed that the solutions were effective against eggs of *Anasa tristis*, DeG., *Leptinotarsa decemlineata*, Say, and *Crambus teterrellus*, Zinck., and the lethal concentrations established for *A. perniciosus* were very effective for the control of *Gossyparia spuria*, Mod. (European elm scale).

In Orchard Trials of Dinitro-o-cyclohexylphenol in Petroleum Oil for Control of Rosy Apple Aphis and San José Scale, by W. C. Dutton (pp. 62–65), are described tests carried out in Michigan in 1934 in which practically complete control of eggs of *Anuraphis roseus*, Baker, on apple, and *Myzus cerasi*, F., on cherry was obtained by dormant applications of an oil solution of the compound emulsified with calcium caseinate. More extensive trials against these Aphids and *Aspidiotus perniciosus* on apple were carried out in 1935, when the dinitro compound was used in sodium caseinate emulsions, tank mixtures (with blood albumin emulsifier), and miscible oil preparations. In each type of spray, the concentrations of oil and the ratios of oil to dinitro compound

were varied considerably. The sprays for Aphid control were applied in the first half of April, and those against *Aspidiotus* a little later, when some of the trees were in a delayed dormant condition.

Only the results with one of the caseinate emulsions are given in detail, but the tank mixture and miscible oil preparations of the dinitro compound gave essentially the same degree of control, and against *A. perniciosus* rather better control at the lower concentrations. All 3 species were satisfactorily controlled by dilute sprays containing from 1·2 per cent. oil and 0·05 per cent. of the compound to 2·4 per cent. oil and 0·1 per cent. of the compound without injury to the trees. The percentage control was 98 for *Anuraphis* and 99 for *Aspidiotus* with the weaker of these formulae in a caseinate emulsion, and 99 and 100 for the stronger.

MOORE (Wm.). **Differences between resistant and non-resistant Red Scale in California.**—*J. econ. Ent.* **29** no. 1 pp. 65–78, 5 figs., 10 refs. Menasha, Wis., February 1936. [Recd. May 1936.]

An account is given of tests designed to bring out differences observed in reaction to fumigation with hydrocyanic acid between the resistant and non-resistant forms of *Aonidiella aurantii*, Mask., on *Citrus* in California [*cf. R.A.E.*, A **23** 35, etc.].

The following is the author's summary: The results of fumigations of resistant red scale in a metal fumatorium with uniform concentrations of hydrocyanic acid differed from those obtained in orchard fumigations under tents and from those obtained in a form tent [*cf.* **24** 170]. A series of fumigations of resistant and non-resistant red scale with different concentrations and exposures to hydrocyanic acid developed the following conclusions: The concentration to which the resistant red scale in California is exposed is of double the value of the length of exposure in effecting a kill, which relationship may be expressed as a constant which is the product of the concentration multiplied by the square root of the length of the exposure. The concentration to which non-resistant red scale in California is exposed is of approximately equal value to the length of exposure in effecting a kill, the lethal constant being the product of the concentration multiplied by the length of exposure to the ·8 power. Increasing the temperature reduces the kill of resistant scale decidedly, but slightly improves the kill of non-resistant scale. Low relative humidities are equally unfavourable and high relative humidities are equally favourable to the kill of resistant and non-resistant red scale. These different relationships of concentration, exposure and temperature developed as a result of fumigations in a tight fumatorium serve to explain the contradictory results of experiments conducted in a tight fumatorium and in a tent. The different relationships of concentration and exposure in producing a kill apparently is not a characteristic acquired from previous fumigation, since other insects not normally fumigated show the same characteristics when fumigated with hydrocyanic acid [*cf.* **16** 94] and even with other chemicals not normally used as fumigants [*cf.* **21** 421; **22** 647].

NOBLE (L. W.). **The biological Possibility of Infestation by Flight of the Pink Bollworm Moth.**—*J. econ. Ent.* **29** no. 1 pp. 78–79. Menasha, Wis., February 1936. [Recd. May 1936.]

Fertilised females of *Platyedra* (*Pectinophora*) *gossypiella*, Saund., were isolated from males and cotton and exposed to temperatures

(about 60°F.) comparable to those in which examples of this moth were taken in the upper air some 6,700 ft. above sea level or 3,000–4,000 ft. above ground [*cf. R.A.E.*, A **24** 24] over Tlahualilo, Durango, Mexico, in September 1928, when a strong wind was blowing towards the United States. After 7 days' isolation the moths were able to begin or resume oviposition of fertile eggs. As the conditions of isolation did not include wind movement, the results might not be the same for moths carried along by wind for corresponding periods, but the experiments show that if previously fertilised females should descend in good physical condition they would be capable of laying eggs after 7 days in the air.

EWING (K. P.) & MCGARR (R. L.). **Two Years' Field Experiments on the Control of the Cotton Flea Hopper with several Insecticides.**—*J. econ. Ent.* **29** no. 1 pp. 80–88, 4 figs. Menasha, Wis., February 1936. [Recd. May 1936.]

To determine the comparative efficiency of sulphur, sodium fluosilicate, a commercial mixture of 75 per cent. calcium arsenate and 25 per cent. Paris green and calcium arsenate alone as dusts for controlling the cotton fleahopper [*Psallus seriatus*, Reut.], 62 field plot tests were made in Texas in 1933 and 1934, only the tests made in the latter year being described. Infestation records and counts of squares, blooms and bolls on cotton plants in the treated and untreated plots during the progress of the experiment showed that sulphur and the mixture of calcium arsenate and Paris green were equally effective. Sulphur gave a much better kill of the nymphs, and the mixture a higher kill of adults. The average increase in yield of cotton per acre was 306 lb. for sulphur and 307 lb. for the mixture. In experiments in which direct comparisons of sulphur and the mixture were made, 3 mixture-dusted plots produced an average of 348 lb. or 208·2 per cent. more than the check, and 3 sulphur-dusted plots produced 322·7 lb. or 192·9 per cent. more than the check. The increased yield in the 4 plots dusted with sodium fluosilicate (20 lb. per acre or 11·4 per cent. more than the surrounding check plots) was not sufficient to justify the cost of treatment. Calcium arsenate alone, with which preliminary tests were made in 1934, produced an average increase of 180 lb. per acre.

CREIGHTON (J. T.). **Report on Cotton Leaf-Worm Investigations in Florida, including Temperature and Hibernation Studies.**—*J. econ. Ent.* **29** no. 1 pp. 88–94, 6 refs. Menasha, Wis., February 1936. [Recd. May 1936.]

Alabama argillacea, Hb., which in the latter part of the 19th century was the most destructive cotton pest in the United States, is now of minor importance and is usually held in check by the calcium arsenate dust applied against the boll weevil [*Anthonomus grandis*, Boh.]. It might again become injurious if conditions changed or if it transferred to other food-plants, but at present it is believed to attack only *Gossypium* in the United States, the females ovipositing equally readily on any of the 29 recognised species. In other countries, however, the larvae have been recorded on various food-plants, including coffee in Brazil, tobacco, maize and tomatos in Colombia, and *Urena lobata* and

Malachra rotundifolia in Porto Rico [*cf. R.A.E.*, A **8** 303]. The adults feed on the sweet exudations from cotton and other plants and also pierce various fruits, which they cause to rot.

In Florida, oviposition may begin 3 days after the female has left the pupal case and continue for 15 days. The eggs, which are laid singly, preferably on the lower surface of the leaves, are very numerous, one female having deposited 1,300 in 12 days. The egg, larval and pupal stages average 3·5, 15·4 and 8·8 days, respectively. Pupation usually takes place in a folded leaf, where the pupa is exposed to predators. It has been variously suggested that hibernation occurs in the larval, pupal or adult stages, or that the insect does not survive the winter in Florida. After a detailed examination of the evidence, the author concludes that the moth is a South American species that appears annually. In experiments, moths did not survive for more than 6 days when exposed to temperatures of 7–9°C. [44·6–48·2°F.], and eggs, larvae in various stages and pupae all rapidly died when subject to the same or slightly higher temperatures, thus supporting the theory of migration.

Parasites reared from material collected in Florida comprised *Brachymeria ovata*, Say, *Syntomosphyrum esurus*, Riley, *Sarcophaga lambens*, Wied., *Beskia aelops*, Wlk., *Megaselia scalaris*, Lw., and *Puliciphora* sp., none of which appears to have been previously obtained from *A. argillacea*. Predators, also reported for the first time, were *Podisus maculiventris*, Say, *Zelus bilobus*, Say, *Dysdercus suturellus*, H-S., *Nezara viridula*, L., and *Allograpta obliqua*, Say.

RAINWATER (C. F.). **Occurrence of *Aphis medicaginis* Koch and *Anomis flava fimbriago* Steph. on Cotton in South Carolina.**—*J. econ. Ent.* **29** no. 1 pp. 94–96, 2 refs. Menasha, Wis., February 1936. [Recd. May 1936.]

Aphis medicaginis, Koch (cowpea aphis) was injurious to seedling cotton in South Carolina during the spring of 1934. It attacks the terminal buds, small leaflets and petioles, and only rarely the larger leaves, differing in this respect from *A. gossypii*, Glov. A severe outbreak of Aphids on seedling cotton in South Carolina in 1933, at the time attributed to *A. gossypii*, is now believed to have been due to *A. medicaginis*. To aid in their identification descriptions of both species are quoted from Gillette & Palmer [*R.A.E.*, A **20** 591].

The larvae of *Cosmophila* (*Anomis*) *flava fimbriago*, Steph., caused some injury to leaves and occasionally to squares of cotton in South Carolina during the summer and autumn of 1934. This Noctuid is known to feed on a number of malvaceous plants, and the rarity of records of attacks on cotton is probably due to their being attributed to *Alabama argillacea*, Hb., or *Cosmophila* (*Anomis*) *erosa*, Hb. The larvae were found feeding on the squares at the end of August and the pupae webbed up in leaves at the end of September and through October. Of a batch of pupae collected in the autumn from cotton infested by *A. argillacea*, 7·2 per cent. proved to be *C. flava fimbriago*.

The two species of *Cosmophila* cannot be distinguished in the larval stage and are often confused when adult, as *fimbriago* is sexually dimorphic, the females resembling *erosa*. Larvae of this genus can, however, be differentiated from those of *Anomis*, as the latter have an additional pair of prolegs (4 when newly hatched and 5 when full-grown).

Hixson (E.). **Distribution of hibernated Boll Weevils in an Oklahama Cotton Field.**—*J. econ. Ent.* **29** no. 1 pp. 96–99, 2 figs. Menasha, Wis., February 1936. [Recd. May 1936.]

The following is the author's summary : Distribution of overwintered boll weevils [*Anthonomus grandis*, Boh.] in a heavily infested cotton field in south-eastern Oklahama in late May and early June 1934 showed no relationship to nearness of adjacent woods. The weevils did, however, tend to be more numerous in that part of the field nearest lucerne, and this tendency increased noticeably in the later examinations. Statistical analysis showed a high degree of negative correlation between weevil population and increase in distance from the lucerne field.

Smith (G. L.). **Percentage and Causes of Mortality of Boll Weevil Stages within the Squares.**—*J. econ. Ent.* **29** no. 1 pp. 99–105, 3 figs. Menasha, Wis., February 1936. [Recd. May 1936.]

During the cotton fruiting seasons 1929–31 inclusive, fallen squares and flared and damaged squares hanging on the plants were collected at about 15-day intervals during June, July and August from 8 fields in Louisiana representing different soil types. Examination of this material showed the percentage mortalities of all stages of the boll weevil [*Anthonomus grandis*, Boh.] in hanging squares to be 4·3 in 1929, 12·06 in 1930, 9·24 in 1931 and 11·63 in 1932. The corresponding percentages for fallen squares were 11·42, 41·33, 15·33 and 24·08. Correlation of the mortalities with data on climatic and other factors showed that the immature stages are affected by climate, predators, parasites and proliferation. Of these climate is ordinarily the most important in the case of fallen squares, although of little or no importance in hanging squares. In both cases the order of efficiency of the other factors seemed to be parasites, predators and proliferation. In fallen squares mortality due to predators (mostly ants) amounted to 2 per cent. in 1931 and 1932. Mortality caused by parasitism was mainly due to *Microbracon mellitor*, Say. In 1932 parasitism caused 8·22 per cent. mortality, or about one-third of the total mortality from all causes. Temperature is the most important element in the climatic factor and has the greatest effect on squares on the ground exposed to the sun. The effective fatal maximum temperatures lie from 93°F. upward, varying in efficiency almost directly with increase above that figure. A single day much above 95°F. is sufficient to produce heavy mortality in stages in contact with the earth and fairly exposed to the action of the sun. With rainfall much less than 1½ inches over the 15-day period, mortality was likely to be high, whereas precipitation in excess of that amount tended to reduce mortality. This correlation is not thought, however, to be direct, but to be due to the effect of moisture upon temperature.

Young (M. T.) & Smith (G. L.). **Field-Plat and Cage Tests for Boll Weevil Control.**—*J. econ. Ent.* **29** no. 1 pp. 105–111. Menasha, Wis., February 1936. [Recd. May 1936.]

An account is given of tests with dusts against the boll weevil [*Anthonomus grandis*, Boh.] carried out at Tallulah, Louisiana, in 1933 and 1934 [*cf. R.A.E.*, A **24** 255]. In the field tests, applications were begun as soon as infestation of the squares had reached 10 per cent. and

continued at 4-day intervals. They were made at 7.30 a.m., while the cotton plants were wet with dew and the air calm. If heavy rain occurred with 24 hours, the treatment was discounted or repeated. Weekly square infestation records were begun when 4–5 squares on each plant were punctured and continued until the number of punctured squares fell below this average. The yield per acre was computed from an area in the centre of the plot.

In the cage tests, frame cages covered with 16-mesh screen wire were placed over individual cotton plants. They rested on skeleton platforms with legs set in pails of water to prevent ants from entering. The stems of the plants were covered with sticky banding material and white cloths were stretched across the platforms to catch weevils that fell. In the afternoon 25 active weevils were placed in each cage and the following morning the plants were dusted by means of small hand guns. For 4 days following the applications dead weevils were recorded and removed at frequent intervals.

Square infestation records indicated very good control in 1933 in plots treated with two calcium arsenate and hydrated lime mixtures (1 : 1 and 1 : 2), but yields were smaller than in the plot treated with calcium arsenate alone. In 1934 the average increase in yield of seed cotton per acre was 396 lb. for calcium arsenate alone, 399 lb. for the 1 : 1 mixture and 271 lb. for the 1 : 2 mixture, but in 3 out of 4 tests the increase in yield was greatest with calcium arsenate alone. Hydrated lime alone had no value in control. Field plot tests in general verified cage tests. A mixture of thiodiphenylamine and sulphur (1 : 9) had little if any effect on square infestation but gave an increase in yield of 60 lb. per acre over the untreated plot. Greater mortality was recorded for this mixture in cage tests than for untreated cages, but less than for cages treated with calcium arsenate. In 4 out of 5 tests calcium arsenate and copper arsenite mixtures (80 : 20) gave better results, according to square infestation, than calcium arsenate alone, the average yield for the 5 tests being 152 lb. greater, but calcium arsenate alone produced a somewhat higher mortality than the mixture in the cage tests. Mixtures of derris root dust and kaolin containing 0·5, 1 and 2 per cent. rotenone gave little if any control of *A. grandis* when used at the rate of 4–6 lb. per acre. Higher control in the cages was due to the fact that weevils stupefied by the derris fell to the bottom of the cage and were killed by exposure to sun before they recovered.

FOLSOM (J. W.). **Observations of *Microbracon mellitor* (Say) in Relation to the Boll Weevil.**—*J. econ. Ent.* **29** no. 1 pp. 111–116, 1 fig., 1 ref. Menasha, Wis., February 1936. [Recd. May 1936.]

Observations of *Microbracon mellitor*, Say, the most abundant parasite of *Anthonomus grandis*, Boh., made in Tallulah, Louisiana, in 1934 by means of special rearing cages, are additional to some already noticed [*R.A.E.*, A **18** 170]. The cage is a cardboard cylinder 2 inches high by 3½ inches in diameter, resting in sand in a saucer and covered with a petri dish. A hole in one side is plugged with a cork covered with absorbent cotton on which a mixture of equal parts of honey and distilled water is placed to feed the parasites. These are put in a glass tube which is pushed through a second opening. The tube is then darkened, and the parasites enter the lighter cage. Sound squares into which weevil larvae have been artificially introduced are placed in the

cages for oviposition of the parasites. The females did not oviposit for at least 24 hours after emergence, but usually laid eggs on the second day. The method of oviposition is described in detail. The host larva is stung and paralysed before the egg is actually laid. Most females completed oviposition in 5–15 minutes. They oviposited most actively in August, with a mean daily temperature of 81–87°F. (maximum 90–100°F.), 1–2 (rarely 3–4) eggs being laid daily. One female laid 48 eggs in 37 days. Usually 1 egg was found on or near each weevil larva, rarely 2 and in one instance 4. The eggs, which are described, hatch in August in a little less than 24 hours. The larva completes its feeding period in 3 days, or 4 in cool weather in September, and then spins its cocoon, which is described, on the wall of the weevil cell. The adult eats away the anterior end of the cocoon and gnaws a small hole in the square above the calyx. The normal period from hatching to emergence was 12 days in August and September, including 6 as a larva in the cocoon stage and 3 as a pupa. Unmated females laid eggs readily, but the progeny were all males. Adult life averaged about a fortnight in August and longer in September and October, when maximum longevity was 41 days for males and 70 for females. Unfed adults did not live longer than a week. In the field, oviposition ceased in November, when all the boll weevil larvae in hanging squares were killed by frost. In the laboratory emergence of the adult parasites ceased about the same time; 94 cocoons, kept at outdoor temperatures, remained on 19th December. Some of these, when opened, were found to contain living larvae, as did 2 found in fallen squares on the ground in November, indicating that the winter is passed in the cocoon.

Newell (W.). **Progress Report on the Key West (Florida) Fruit Fly Eradication Project.**—*J. econ. Ent.* **29** no. 1 pp. 116–120. Menasha, Wis., February 1936. [Recd. May 1936.]

Fruit-flies were first observed on Key West, Florida, in 1930, the injurious species being finally identified in 1931 as *Anastrepha acidusa*, Wlk. [*cf. R.A.E.*, A **22** 325]. In September 1932 infestation in hog plums (*Spondias mombin*) was found on 81 properties, in guavas (*Psidium guayava*) on 6, and in Barbados cherries (*Malpighia* sp.) on 3. Investigations begun in 1932 showed that in addition to *A. acidusa*, which shows a preference for *S. mombin*, two other species of *Anastrepha* occur on the island, including *A. suspensa*, Lw., which shows an apparent preference for guavas. Under laboratory conditions over 30 different fruits are attacked by *A. acidusa* and 11 by *A. suspensa* [*loc. cit.*]. A bait-spray of 4 lb. tartar emetic, 5 U.S. gals. syrup and 100 U.S. gals.water is rapidly toxic to these fruit-flies. The progress is traced of an eradication campaign begun in August 1933, which involved quarantine, inspection and investigation activities, destruction of all fruits known to be subject to attack, and repeated spray applications to all trees producing such fruits. Traps baited with a fermenting mixture of citrus juice and brown sugar were used with success to indicate progress in eradication. Following the measures adopted in 1933, when 9 centres of infestation were recorded, only one doubtful infestation (in fig) was recorded in 1934, and it is believed that complete eradication will eventually be effected without prohibitive cost.

Smith (M. R.). **Consideration of the Fire Ant *Solenopsis xyloni* as an important Southern Pest.**—*J. econ. Ent.* **29** no. 1 pp. 120–122. Menasha, Wis., February 1936. [Recd. May 1936.]

Solenopsis geminata xyloni, McCook, which occurs in the United States within an area bounded on the north by 35°N. Lat. and extending from the Atlantic to the eastern boundary of Arizona, with the exception of Florida, is particularly troublesome in the coastal region of the Gulf of Mexico. Its nests are very numerous in towns and rural areas in Mississippi [*cf. R.A.E.*, A **23** 171] and contain many thousand individuals. They are generally in freely exposed soil areas, but are sometimes found under débris or beneath clumps of grass, and also in masonry. The construction of the nest is described. In Mississippi, this ant is the only one that inflicts painful stings except *S. geminata*, F., and *Pogonomyrmex badius*, Latr. Its stings produce sores on young children and kill poultry and quail at the time of hatching. It is omnivorous, but prefers meats, butter, nuts and greasy foods. Unlike *Iridomyrmex humilis*, Mayr, it gnaws holes in linen, silk, woollen and cotton articles, soiled clothes being most readily attacked. It also damages vegetable gardens by removing seeds from the seed-beds, and fosters a number of Aphids and Coccids. It girdles young nursery stock, such as *Citrus* and pecan, and gnaws into the buds, base of the fruits or stems of other plants. Although it often destroys insect pests, such as the immature stages of *Anthonomus grandis*, Boh., this does not outweigh the injuries it causes. No appreciable control appears to be exerted by natural enemies, which include poultry and Phorid parasites of the genus *Plastophora*. It cannot be successfully controlled by means of sweet poison baits, but fumigation of the nests where accessible in the soil has given promising results.

White (G. F.) & Noble (L. W.). **Notes on Pink Bollworm Septicemia.** *J. econ. Ent.* **29** no. 1 pp. 122–124, 4 refs. Menasha, Wis., February 1936. [Recd. May 1936.]

A disease was observed in the laboratory in Texas in 1932 among mature larvae of the pink bollworm [*Platyedra gossypiella*, Saund.], which interfered with the breeding of parasites but has not been seen in the field. Microscopic examination of smears from diseased and recently dead larvae showed the presence of a few species of bacteria, including two of *Bacillus* and one of *Streptococcus*, which were obtained in pure cultures. Of 20 larvae inoculated (by needle puncture) direct from diseased larvae, 3 died and became discoloured within 24 hours, and all were dead within 48 hours. Inoculations from the pure cultures showed that one of the species of *Bacillus* and the *Streptococcus* were not pathogenic, but all of 50 larvae infected with the other *Bacillus* died within 24 hours. This organism which is named *Bacillus pectinophorae*, sp. n., is a small non-spore-bearing rod, which forms grey colonies on agar. Members of the group are easily destroyed by heat, drying, sunlight and chemical disinfection. Comparison with the description by Metalnikov and Metalnikov of the micro-organisms encountered by them in working with *P. gossypiella* [*R.A.E.*, A **20** 245; **21** 365] shows them to be distinct.

A slight resistance to the disease observed in larvae paralysed by parasites was thought to be due to temporary cessation of circulation.

Paralysed and normal larvae, together with some that had been killed by hot water, were inoculated simultaneously for comparison. All normal larvae died within 48 hours and turned brown. Of the group killed by hot water 4 discoloured in 48 hours and the remainder within 4 days. Of the paralysed larvae, 4 discoloured in 48 hours, one on the third day and 5 remained in a state of preservation for 9 days. Two of this group retained their normal colour for 20 days. Measures for preventing the disease include sterilisation by heat of breeding cages and receptacles and avoidance of crowding in the containers.

Boyce (A. M.). **The Citrus Red Mite** *Paratetranychus citri* **McG. in California, and its Control.**—*J. econ. Ent.* **29** no. 1 pp. 125-130, 8 refs. Menasha, Wis., February 1936. [Recd. May 1936.]

Paratetranychus citri, McG., was probably introduced into California from Florida about 1890. In California, where its preferred food-plants appear to be lemon, oranges and grapefruit in the order named, it is more injurious than in other States, but is of economic importance only in the coastal and sub-coastal areas, where relative humidity is generally higher than in the interior valleys, and temperatures are lower in summer and a little higher during the rest of the year. Infestation is greatest from April to June, though it is often again severe from October to December and sometimes throughout warm winters or very cool summers.

The mites feed on the leaves, fruit and green bark of new growth, eventually causing defoliation and dying back of twigs. The market value or size of the fruit is sometimes impaired. One female deposits 20–50 eggs on leaves, fruit and twigs. The mites hatch in 8–30 days and may then reach the adult stage in as little as 8 days under very favourable conditions. The sexes are present in about equal proportions, but in some cases parthenogenetic reproduction, producing only males, occurs.

The development of control measures since 1902 is briefly reviewed, the use of sulphur having been almost abandoned during the past 6–8 years in favour of oils. Oil sprays give good control but are in some cases undesirable for various reasons. Where hydrocyanic acid gas is used to control Coccids, the mite often increases, as it is little affected whereas its natural enemies are destroyed. The most promising material other than oil used against it is selenium in the form of Selocide, although in certain areas and under certain conditions combinations of this material have not given satisfactory results. Selocide concentrate is a 30 per cent. solution of potassium ammonium selenosulphide [*R.A.E.*, A **21** 565]. A large number of laboratory tests and control experiments have shown that Selocide at 1 : 800 is as effective as at higher concentrations, and that its effect is increased by the addition of lime-sulphur (1 : 300), wettable sulphur (2 lb. to 100 U.S. gals. spray), or light-medium mineral oil (1 : 300). The first two combinations kill only those eggs in which the embryo is almost developed, but a residue deposited on the tree destroys young mites soon after they hatch if not washed off by rain. The Selocide-oil combination gives a high initial kill of mites and eggs with which it comes in contact but has no apparent residual effect. In comparative experiments, it generally gave a higher degree of control than Selocide and lime-sulphur although in certain cases the latter was superior. A

combination of Selocide and oil with lime-sulphur (1 : 300) caused injury to the trees, but with wettable sulphur (1 lb. in 100 U.S. gals.) appeared to be relatively non-injurious to the tree and gave very effective control of the mite. Of wetting agents tested with Selocide combinations, calcium caseinate ($\frac{1}{3}$ lb. to 100 U.S. gals.) was the best. Results secured with a number of other materials are briefly discussed.

BASINGER (A. J.). **Notes on the Orange Worms** *Argyrotaenia* (*Tortrix*) *citrana* **Fern. and** *Platynota stultana* **Wlsm.**—*J. econ. Ent.* **29** no. 1 pp. 131–134, 1 fig., 3 refs. Menasha, Wis., February 1936. [Recd. May 1936.]

The Tortricids, *Eucosma* (*Argyrotaenia*) *citrana*, Hb., and *Platynota stultana*, Wlsm., have been known for about 50 years in California, where they attack a variety of plants. *E. citrana* is by far the most abundant and destructive of the so-called orange worms in southern California, but *P. stultana*, although liable to attack *Citrus* [*cf. R.A.E.*, A **23** 31], sometimes working as a leaf-roller, caused calyx injury to oranges in 1934 and 1935 in only a very small percentage of cases. Notes are given on its synonomy [**22** 108]; some of the earlier injury to oranges attributed to it was found to be due to the Tineid, *Holcocera iceryaeella*, Riley [**13** 48].

The young larvae of any of these moths crawl under the sepals of oranges or grapefruit, if the fruit happens to be small when they hatch, and nibble the surface, but data obtained in 1934 and 1935 showed that this injury did not affect the growth of oranges, nor did it appreciably reduce the grade of the fruit.

HOSKINS (W. M.) & WAMPLER (E. L.). **Factors concerned in the Deposit of Sprays. II. Effect of Electrostatic Charge upon the Deposit of Lead Arsenate.**—*J. econ. Ent.* **29** no. 1 pp. 134–143, 4 figs., 13 refs. Menasha, Wis., February 1936. [Recd. May 1936.]

The following is the authors' summary of experiments undertaken to determine how the electrostatic charge of lead arsenate suspensions is affected by a number of electrolytes and what changes in the amount of deposit are caused thereby [*cf. R.A.E.*, A **13** 333]: A microcataphoresis cell for the determination of the electrostatic charge of suspensions is described and figured. Suspensions of acid lead arsenate in water have a negative charge. Very low concentrations of polyvalent positive ions, *e.g.*, Al+++, decrease this charge and higher concentrations give a strong positive charge to the suspension. Beeswax suspensions act similarly to lead arsenate. Solutions containing aluminium ion in the concentration range which gives little or no charge to particles of wax in suspension, wet a surface of the same kind of wax. The deposit of lead arsenate varies with the concentration of aluminium present. It is increased by concentrations which give a low positive charge to the lead arsenate and leave a negative charge on the wax surface, but it is greatly diminished when both the lead arsenate and the wax are positively charged. The effect of wetting agents upon this effect is dependent upon the amount used.

Broadbent (B. M.) & Bliss (C. I.). **Comparison of Criteria of Susceptibility in the Response of *Drosophila* to Hydrocyanic Acid Gas. II. Recovery Time.**—*J. econ. Ent.* **29** no. 1 pp. 143–155, 4 figs., 4 refs. Menasha, Wis., February 1936. [Recd. May 1936.]

The following is the authors' summary : The time of recovery from paralysis due to fumigation with hydrocyanic acid has been compared with other toxicological indices in adult *Drosophila melanogaster*, Mg. [*cf. R.A.E.*, A **24** 171]. Since the logarithms of this period were distributed symmetrically and normally in an experiment in which all the flies recovered, the recovery time has been expressed in logarithms for purposes of analysis. In most tests some flies failed to recover, but by means of a graphic method, which is described, it was possible to treat all experiments on a common basis. The straight lines relating percentage recovery (in probits) and recovery time (in logarithms) [*cf.* **22** 440] were usually in satisfactory agreement with the observations over the entire range of recovery times. In some cases the last flies to recover were delayed beyond the time expected from the curve, a trend which suggested that their slower rate of recovery was limited by secondary physiological reactions. The logarithm of the time for 30 cent. recovery (x) has been determined by graphic interpolation and then correlated with the concentration of hydrocyanic acid (C) and the exposure period in minutes (t). For 94 experiments in which mortality ranged from 4 to 85 per cent. kill, the relation could be expressed satisfactorily by the partial regression equation $x=2{\cdot}0164+1{\cdot}399$ (log. $C-{\cdot}0148)+{\cdot}813$ (log. $t-{\cdot}6536$). As computed from this equation, 30 per cent. of the flies recovered in 186 minutes from a median lethal dose of 1·26 mg. of hydrocyanic acid per litre for 6·56 minutes. By substituting the logarithm of 186 for x in the regression equation, it could be reduced to the form $C^{1{\cdot}7}t=9{\cdot}8$. Because of its similarity to that derived for 50 per cent. kill from the concentration-mortality curves [**24** 171], both relations were assumed to measure the same toxicological process. An analysis of the variance of these two indices of toxicological response showed that the recovery interval was a more precise measure of poisoning than the percentage killed.

Several criteria of susceptibility have been compared in individual flies. The correlation between stupefaction and recovery time was consistent with that expected from the experimental conditions, in one case being zero and in the other small ($r=-{\cdot}201$) but significant, and indicating that individuals that succumbed more quickly to the gas usually required a longer time for recovery. In most cases the percentage of incomplete recovery increased with the length of time required to recover, although sometimes the two criteria were quite independent. When not independent, the delayed mortality in probits was directly proportional to the logarithm of the recovery interval, but the percentage of flies that died within two days after recovering at a given time varied from one experiment to another. In three groups of tests recovery periods of 77, 176 and 360 minutes, respectively, were followed by 50 per cent. mortality. In 50 flies that survived fumigation on two successive days, the logarithm of the time to recover from the first treatment was correlated with the logarithm of the time to recover from the second treatment. The correlation coefficient of ·529 indicated that at least in part the variation in susceptibility was static, so that individuals judged in reference to their susceptibility by one test would be similarly classified in a second test.

JONES (L. S.). **Notes on the Control of *Anarsia lineatella* in California.** —*J. econ. Ent.* **29** no. 1 pp. 156–160, 1 ref. Menasha, Wis., February 1936. [Recd. May 1936.]

In preliminary tests of sprays of lime-sulphur and basic lead arsenate against overwintered larvae of *Anarsia lineatella*, Zell., on peaches in California in 1932 [*cf. R.A.E.*, A **24** 172], basic lead arsenate used at the rate of 3 lb. to 100 U.S. gals. water with the addition of a suitable spreader gave 100 per cent. control when applied just after the blossoming stage. Lime-sulphur alone was of little or no value. Applications should be completed within 10–15 days of full bloom and before the larvae have time to pupate. The spray may be timed by means of orchard inspections to secure coverage when the greatest number of overwintered larvae are feeding.

In the same year applications of sprays or dusts of basic lead arsenate, and sprays of natural cryolite, and oil and nicotine sulphate were made against subsequent broods of *A. lineatella* in June, July and August. The results are tabulated ; the best (up to 69 per cent. control) from a single treatment were secured by means of a June spray of basic lead arsenate (3 lb.), but the value of late sprays during years when large populations of borers are present cannot be predicted on the basis of the work recorded.

BASINGER (A. J.) & BOYCE (A. M.). **Orange Worms in California and their Control.**—*J. econ. Ent.* **29** no. 1 pp. 161–168, 2 refs. Menasha, Wis., February 1936. [Recd. May 1936.]

Injury to the fruits of *Citrus* in California is caused by the larvae of *Eucosma* (*Argyrotaenia*) *citrana*, Hb., *Holcocera iceryaeella*, Riley, and *Platynota stultana*, Wlsm., oranges and grapefruit being primarily affected. It may consist of a hole extending through the rind into the fleshy portion, or may be only superficial. Affected fruits either drop before picking time or are graded out in the packing house. *E. citrana* has been the most important of these " orange worms " in California since it was first recorded there in 1885. It was later found that *H. iceryaeella*, which is rather generally present throughout the coastal citrus areas, causes damage, principally to Valencia oranges [*cf. R.A.E.*, A **13** 48], but *P. stultana* has not been found infesting oranges in sufficient abundance to be economically important [*cf.* **23** 31]. In localities where injury is due almost entirely to *E. citrana*, which is very highly parasitised and is adversely affected by high temperatures, it has occurred periodically every 5–7 years, but *H. iceryaeella* maintains a more uniform population year after year, as it is not highly parasitised and occurs mainly in coastal areas where climate is uniform. In the coastal areas, however, infestations consist mainly of mixed populations of both moths. Losses commonly amount to 10–15 per cent. of the crop and may be as high as 40 per cent., and the value of fruit destroyed in the outbreak of 1933–34 in southern California is estimated at £20,000.

Laboratory and field experiments carried out from 1933 to 1935, details of which are given, following earlier experiments in 1925, showed that these pests can be satisfactorily controlled by sprays or dusts containing cryolite (natural or synthetic) or barium fluosilicate. These insecticides can be combined materials used against other pests of *Citrus*, including oils against scale insects and *Paratetranychus citri*,

McG., nicotine and derris compounds (except barium fluosilicate with nicotine sulphate) against Aphids, sulphur dust against thrips, and zinc oxide against the mottle-leaf disease.

Collins (C. W.), Buchanan (W. D.), Whitten (R. R.) & Hoffmann (C. H.). **Bark Beetles and other possible Insect Vectors of the Dutch Elm Disease** *Ceratostomella ulmi* **(Schwarz) Buisman.**—*J. econ. Ent.* **29** no. 1 pp. 169–176, 3 refs. Menasha, Wis., February 1936. [Recd. May 1936.]

A brief account is given of investigations carried out by the United States Department of Agriculture since August 1933 on the insect vectors of *Ceratostomella ulmi*, including notes on the biology of *Scolytus multistriatus*, Marsh., and *Hylastes* (*Hylurgopinus*) *rufipes*, Eichh. [*cf. R.A.E.*, A **24** 139, 180] and descriptions of the galleries of the former. *S. multistriatus* has been taken by the authors in New Hampshire, Delaware and other localities from which it has hitherto been unrecorded, and *H. rufipes* is widely distributed in the eastern States. Some larvae of the former were found capable of completing development after 2 months submergence in tap water [*cf.* **22** 339]. Logs seasoned for 3 days were suitable for attack by it, those a month old less favourable and those 3 months old attacked reluctantly.

Although the disease is concentrated in an area where *S. multistriatus* is abundant and *H. rufipes* also occurs, the distribution of *H. rufipes* is far wider and *S. multistriatus* is found in eastern Massachusetts and southern New Hampshire where infection has not been observed. Except for occasional instances, which may be due to experimental error, attempts to transmit *C. ulmi* with any species other than these two bark-beetles have proved negative. Transmission experiments, the technique of which is described, have been carried out unsuccessfully with the following: *Galerucella luteola*, Müll. (*xanthomelaena*, Schr.), and *Popillia japonica*, Newm., which feed on elm foliage; *Ceresa bubalus*, F., the females of which deposit their eggs in elm twigs; *Tibicen linnei*, Sm. & Grsb. (*chloromera*, Wlk.), which does the same in confinement; *Eutetrapha* (*Saperda*) *tridentata*, Ol. (elm borer), and the bark weevils, *Magdalis armicollis*, Say, and *M. barbita*, Say. Elms have, however, occasionally been found to be infected without showing any trace of either *S. multistriatus* or *H. rufipes*. In tests with arsenicals against adults of *S. multistriatus* feeding in crotches, magnesium arsenate killed the beetles more quickly than lead arsenate when both were used at the rate of 10 lb. to 100 U.S. gals. water. In order to be effective, the poison must act quickly and remain on the twigs during most of the growing season.

Worthley (L. H.). **Progress in Dutch Elm Disease Eradication.**—*J. econ. Ent.* **29** no. 1 pp. 176–181. Menasha, Wis., February 1936. [Recd. May 1936.]

A campaign to eradicate all elm trees infected with *Ceratostomella ulmi* and to locate and destroy all dead and dying elms that were potential sources of the fungus was organised in the United States with funds allocated in December 1934. Work was practically completed in Connecticut and New York and in about half the infested area in New Jersey, and all trees then known to be infected had been destroyed by 15th April 1935. By the time that funds became exhausted

early in May about 430,000 dead or dying elms had been felled, and 240 trees infected with *C. ulmi* had been eradicated. Further allocations were made conditional upon employment of inexperienced men from among the unemployed, except for a few supervisors, which caused various difficulties in carrying on the work. Of 2,500 suspected trees observed between 11th May and 1st July, 955 had Dutch elm disease. Activity of overwintering adults of *Hylastes* (*Hylurgopinus*) *rufipes*, Eichh., was reported on 24th April, and emergence of adults of *Scolytus multistriatus*, Marsh., was observed on 10th May. Systematic scouting for infected trees was carried out from 1st July to 15th September, when the number of men employed reached 3,800. The entire infected zone was covered once, two-thirds of it twice and a few sections three times. About 60 per cent. of the protective zone received a systematic survey, and about 20 per cent. of the outside territory. Of 34,160 suspected trees, 18 per cent. proved to be infected, 75 infections being found in Connecticut, 3,851 in New Jersey, 2,092 in New York and 18 in isolated cities outside the major disease zone. Prompt eradication did not, however, overcome the handicap of fungus spread by insect vectors having emerged early in summer, while scouting was being delayed. During the summer 210,000 dead and dying trees were destroyed, bringing the total since work began in January 1935 to 650,000. Special pains were taken to destroy isolated infections before a major outbreak could develop. Since the discovery of the disease in the United States in 1930, 13,969 cases of infection have been found. At the end of October 1935 only 39 trees known to be infected remained standing. The known infected zone was increased by 47 per cent. in 1935, the largest proportionate increase being from 852 to 1,495 sq. miles in New York. The major diseased area now covers 3,640 sq. miles, and the 10-mile protective band comprises an additional 2,185 sq. miles. All diseased elms found outside the infected zone of 1934 are within 50 miles of New York City.

It has been conclusively shown that *C. ulmi* can be transmitted through natural root grafts between elms, and this root grafting is common in an important infection centre in New Jersey where an attempt is being made to clean out an area of 6 square miles of wooded swamp. The removal of elms showing external symptoms will not eradicate the disease, as the underground residue of living fungus would continue to spread it. A chemical is, however, to be used to kill the stumps and prevent further sprouting in order to preserve an elm-free zone for a period of several years.

Headlee (T. J.) & Jobbins (D. M.). **Further studies of the Use of Radio Waves in Insect Control.**—*J. econ. Ent.* **29** no. 1 pp. 181–187, 1 fig., 29 refs. Menasha, Wis., February 1936. [Recd. May 1936.]

The nature of the agency killing insects subjected to radio waves in the electrostatic field is discussed [*cf. R.A.E.*, A **23** 375, 569, etc.]. The available data indicate that injury to the insect is due to accumulation of lethal temperature within its body [**21** 327], and that the amount of energy absorbed by the insect in the electrostatic field depends upon the frequency of oscillation and the voltage gradient or power with which it is applied. This absorbtion occurs more readily at higher frequencies and more rapidly at higher voltage gradients. These relations are indicated in a graph recording data obtained from a study of

Tribolium confusum, Duv., in which the constant was a period of 30 seconds from the time of beginning of application till death, which shows that the lower the frequency the greater the voltage required and *vice versa*. The frequency range covered about 6–48 million cycles per second, the rapid change portion lying between 6 and 23 and the slow change between 23 and 48 million. Apparatus adequate for power production at higher frequencies is difficult to obtain and to build in the laboratory, so that it cannot be discovered whether this flattening of the curve means that there are no further rapid changes in requirements of volts potential beyond 48 million cycles per second.

It has been shown that different substances absorb electric energy in the electrostatic field upon the basis of their electrical conductivities and dielectric constants, which vary very widely. Thus differences occur in the rate of developing heat between different stages of the same insect, and to a less degree between individuals of the same species. When for different individuals in the same stage of development the critical voltage gradient has been reached, the difference in voltage gradient necessary to increase from 90 to 100 per cent. kill is small, being of the order of 9 per cent. increase in volts potential, whereas the increase necessary to kill the egg as compared with that necessary to kill the larva is in the order of 200 per cent. Data obtained with *Bruchus obtectus*, Say, and *T. confusum* show the order of difficulty in obtaining kill in the electrostatic field, beginning with the most difficult, to be egg, larva, pupa, adult. In order to kill all stages in an insect infestation, it is necessary to bring the food in which the insect is feeding, and by which it is more or less sheltered, to a temperature that is lethal to the insect. If a living plant is involved and is in the seed stage, the lethal temperature sufficient to destroy the insect usually produces no effect on the plant or stimulates it to greater germination activity.

The possibility of modifying the effect of the electrostatic field upon insects subjected to its influence through resonance and through modifications of the sine wave remains to be explored.

WOLFENBARGER (D. O.). **Insect and Disease Evaluations in Potato Experiments.**—*J. econ. Ent.* **29** no. 1 pp. 187–189, 1 fig., 4 refs. Menasha, Wis, February 1936. [Recd. May 1936.]

A model or figure is described and illustrated by which flags standing on a rectangle of paper depict the yield of potatoes in experiments in New York State as being influenced by injured leaf surfaces resulting from attacks by leafhoppers [*Empoasca fabae*, Harr.] and flea-beetles [*Epitrix cucumeris*, Harr.] and from early blight disease. Yield is shown by the length of the flag, hopperburn injury by its height and injury by the other two causes by its distance from one side or end, respectively, of the paper. Letters at the base of each flag show the treatment represented by the flag and figures indicate the number of applications made. Treatments included applications of Bordeaux mixture in various concentrations alone and in combination with calcium arsenate, and of copper lime dust. As the number of leaf injuries increased the yield decreased in linear relationship. The largest yields tended to come from plants that received the most Bordeaux mixture. Flea-beetle holes were statistically significantly associated with the yield and were not significantly associated with hopperburn and early blight. Hopperburn was significantly associated

with early blight. The relative effects on yield were as follows : hopperburn 1 per cent., early blight 28 per cent. and flea-beetle holes 71 per cent.

CRAIG (F. W.). **Economic Control of** *Magicicada* (*Tibicina*) *septendecim* **L. in a Grove of Century-old Oaks (Cicada-Homoptera).**—*J. econ. Ent.* **29** no. 1 pp. 190–192, 1 fig., 1 ref. Menasha, Wis., February 1936. [Recd. May 1936.]

To protect a 30-acre grove of fine old oaks situated in the north-eastern corner of the swarm area of brood XI of *Magicicada septendecim*, L., which appeared in south-eastern Virginia in 1935, the trees were banded with two or three rings of an adhesive, and the cicadas massed below them were scraped off the bark with a bamboo rake and burned. The bands checked the progress of the nymphs and allowed a greater time to elapse between successive collections. Nymphs emerged from 21st May to 18th June, reaching maximum numbers on 31st May. A total of 193 bushels of insects, including those trodden underfoot by the workers, was estimated to have been destroyed, representing 1,235,000 to 1,544,000 individuals or about 1 per sq. ft. of soil. Compared with infestations in other groves, judged by holes in the bare ground, this infestation was fairly light. The cost of the operation, in which 5–7 men were employed regularly from 6 p.m. to 1 a.m. for a month, is estimated at £120. When the grove was visited in early July only a few damaged twigs were observed, whereas similar groves in the dense swarm area showed hundreds of dead twigs to a tree. No perceptible numbers of adult cicadas moved into the protected area from somewhat thickly populated trees on two knolls, 1,000 ft. apart, on each side of one end of the area. In view of this absence of migration of adults and the fact that few larvae hatched within the protected area, it is believed that very few adults will emerge there in 1952 or thereafter.

ZAPPE (M. P.). **Notes on a Japanese Weevil,** *Calomycterus setarius* **Roelofs, in Connecticut.**—*J. econ. Ent.* **29** no. 1 pp. 193–195, 9 refs. Menasha, Wis., February 1936. [Recd. May 1936.]

Records of the occurrence of *Calomycterus setarius*, Roel., in Pennsylvania, Maryland, Connecticut and New York, where it was discovered, for the first time in America, in 1929 [*R.A.E.*, A **18** 454] are briefly reviewed [*cf.* **21** 511, **24** 33]. The adults have caused slight injury to a large variety of ornamental plants and shrubs. Although there are no available references to the life-history, it was assumed from analogy with allied weevils that the immature stages are spent in the ground. Soil taken from a greenhouse and other places where adults had been numerous and examined in the laboratory was not, however, found to contain either eggs or larvae. As pairing has never been observed, reproduction may be parthenogenetic, which would account for the rapid increase of the weevils.

TURNER (N.) & ZAPPE (M. P.). **Termite Damage in Connecticut.**—*J. econ. Ent.* **29** no. 1 pp. 195–198, 5 refs. Menasha, Wis., February 1936. [Recd. May 1936.]

Damage to buildings in Connecticut by *Reticulitermes flavipes*, Kollar [*R.A.E.*, A **23** 552] further increased in 1935, when the cost of replacing damaged wood and installing metal barriers to prevent further attack for 105 infested buildings was £20,000. The infestations

are widely distributed and locally intense, and it is pointed out that almost 70 per cent. of the entries in modern buildings were through wood in actual contact with the ground, indicating faulty construction methods in many cases. The work of commercial termite control companies is discussed. Some of these depend upon metal shields and structural changes and others on soil treatments or pressure impregnation of timber through small holes drilled at occasional points, or a combination of both methods. Reliance should be mainly placed on structural measures [*cf.* **24** 387], and the use of termite-proof construction is urged in all permanent new buildings. Services rendered by the Experiment Station at New Haven in examining buildings, advising as to structural changes needed to exclude termites and submitting suggestions for control are outlined.

Back (E. A.). *Gryllus domesticus* **L. and City Dumps.**—*J. econ. Ent.* **29** no. 1 pp. 198–202, 4 refs. Menasha, Wis., February 1936. [Recd. May 1936.]

Gryllulus (*Gryllus*) *domesticus*, L., considered an introduced insect, is now widely distributed throughout the United States east of the Rocky Mountains. Serious house infestations occurring in 35 cities or towns between 1921 and 1935 were all the result of migration from city refuse dumps. A severe outbreak in Baltimore in 1926 originating in a waste paper dump is described. Hordes of crickets emerged from the débris at dusk and migrated several hundred feet to the nearest dwellings. In addition to the excessive annoyance caused, clothing of all kinds was badly eaten. From conditions in and near Washington, D.C., it is believed that the crickets pass the winter in the dumps themselves, as well as in and about houses, sheds, etc. After an outbreak in the summer of 1934 crickets were reported to have caused annoyance in a cellar during the entire winter. Examinations from May to November 1935 showed crickets in all stages of development present in the refuse dumps. Migrations, which occur in largest numbers between July and October, are the result of overpopulation or in some cases scarcity of food. It appears that the crickets disappear automatically when the dumps are closed down and covered with ashes or soil. Brief reference is made to measures that have proved effective in controlling crickets, the application of poison baits being the safest and most satisfactory. Three formulae in use for the control of crickets and grasshoppers are: 5 lb. bran, ¼ lb. sodium fluosilicate, 1 U.S. pint cane molasses, and 2 U.S. pints water; 100 lb. wheat bran, 2 lb. sodium arsenite, 3½ U.S. gals. water, and 1 U.S. gal. strong molasses, which is rendered more attractive by the addition of beef extract; and 50 lb. wheat bran, 1 lb. Paris green or white arsenic, 2 U.S. gals. cheap molasses, 3–4 U.S. gals. water, and 6 finely chopped oranges or lemons. Within the house, crickets have been controlled by dusting with pyrethrum powder, sodium fluoride or sodium fluosilicate.

Walker (H. G.), Anderson (L. D.) & Willey (C. R.). **European Corn Borer on the eastern Shore of Virginia.**—*J. econ. Ent.* **29** no. 1 pp. 202–204, 1 ref. Menasha, Wis., February 1936. [Recd. May 1936.]

Pyrausta nubilalis, Hb., which was first found to occur in the coastal region of Virginia in 1931 and was still very scarce there in 1932,

was shown by a survey of 52 maize fields in August and September 1934 to have spread over practically the whole shore area from Eastville to Maryland. The percentage of stalks infested varied from less than 1 to 58, with an average of 10 in most of the maize fields. Observations in 1935 showed that not only two generations but also at least a partial third are produced in a year, which probably accounts for the rapid spread of infestation since 1932. It was also found that potato is one of the principal food-plants for the first generation larvae ; few maize plants are available for oviposition when the moths of the overwintered generation are in flight. In 1935 many maize fields had 80 per cent. of the stalks infested, one having 96 per cent. with an average of 10 borers per stalk and 28 per plant. Examination on 9th October showed an average number of borers per stalk of 2·9 and 2·25 for maize planted on 14th May and 27th June, respectively, and 5 and 5·85 for that planted on 1st and 10th June, a difference that is statistically significant. Maize planted on 27th June failed to give a satisfactory crop. The percentage of infested stalks for a given planting increased rapidly from the end of August to the beginning of October. Thorough scouting in the autumn of 1935 in other parts of eastern Virginia failed to show the presence of *P. nubilalis*, but if it continues to increase as rapidly in the coastal area as it has in the past two years, it will become very destructive there to maize and possibly to other crops.

Carruth (L. A.). **Experiments for the Control of Larvae of *Heliothis obsoleta* Fabr. on western Long Island during 1935.**—*J. econ. Ent.* **29** no. 1 pp. 205–209, 5 figs. Menasha, Wis., February 1936. [Recd. May 1936.]

An account is given of two experiments in the control of *Heliothis armigera*, Hb. (*obsoleta*, F.), carried out in 1935 on western Long Island, where it has recently become a serious pest of sweet maize. The first consisted of comparative tests of 6 mechanical and 4 insecticidal treatments extending from 28th August to 12th September, the maize being harvested in two pickings some days later. A field of 6 blocks, each containing 10 treated and one untreated plot was used. When treatment was begun 34·8 per cent. of untreated plants were in silk, 90·7 of 140 ears examined being infested with eggs of *H. armigera*. At harvest the ears were graded according to 4 degrees of infestation, injury by *Laphygma frugiperda*, S. & A., representing about 10 per cent. of the total, being included. Most of the treatments used significantly reduced the amounts of infestation and injury. The mechanical treatments consisted of clipping off the silks and husk tips with shears to free them from eggs and young larvae and then covering them with screen wire, plain or perforated cellophane bags, glassine grape bags, or plain paper bags or leaving them uncovered. They all gave more favourable results than any of the insecticidal treatments except in the case of perforated cellophane bags. The clipping was done after the silks had begun to wither, except in the case of the screen wire or perforated cellophane covers, which were put on soon after the silks appeared. Uncovered ears were clipped more than once if necessary.

The insecticidal treatments consisted of 5 applications of dust to the silks. The four dusts were 25 per cent. lead arsenate, 25 per cent. sulphur and 50 per cent. flour, and barium fluosilicate, synthetic

cryolite and natural cryolite each used at the rate of 25 per cent. with flour. The percentage of infested ears after treatment was lead arsenate 67·8, barium fluosilicate 68, synthetic cryolite 69·5, and natural cryolite 64·9, as compared with 92·6 for untreated maize and 72·7 for ears in perforated cellophane bags. Most of the small larvae found in clipped but uncovered ears at harvest (52·1 per cent. infested) were due to re-infestation after final clipping treatment, and few of the ears were severely injured (11·7 per cent. unfit for sale). About 700 ears of maize could be clipped and disinfested by one man in an hour. Objections to clipping are the risk of exposing the ear tip when more than two treatments are made, and the ease with which migrating larvae can enter the ears. Plain paper bags, the cheapest coverings used, were as satisfactory as any other covering material (39·9 per cent. of the ears infested; 13·4 per cent. unfit for sale).

In the second experiment, the maize was planted in a moth-proof enclosure, the construction of which is described. Although the ears were protected, the enclosure was too expensive for practical use.

Friend (R. B.) & Hicock (H. W.). **Notes on the European Pine Shoot Moth.**—*J. econ. Ent.* **29** no. 1 pp. 210–214, 2 refs. Menasha, Wis., February 1936. [Recd. May 1936.]

Records of the status of infestation of pines by *Rhyacionia buoliana*, Schiff., in 1934 and 1935 throughout Connecticut show that there has been a noticeable decrease in abundance since the previous report [*R.A.E.*, A **21** 233]. This is due to control measures carried out throughout the State and to the severe winter of 1933–34. The object of the control measures has been to eliminate *R. buoliana* from young plantations, or so to reduce its numbers that a local outbreak, which in red pine [*Pinus resinosa*] takes 3–5 years to build up, could not occur before the stand closed. Outbreaks rarely occur after the closing of a stand.

Except in Fairfield county, where infestation was severe but where only 11 plantations were dealt with in 1934 as compared with 152 in 1935, control work having been concentrated on other parts of the State, the distribution and intensity of infestation were both much reduced in the latter year. The greatest decrease occurred in the northern tier of counties, where general infestation had never been severe and where the winters are colder.

As the amount of infestation is correlated with the age of red pine stands as reflected in their height, it may be expected to decline, in spite of favourable environmental conditions, as the proportion of very young stands decreases. Work in Fairfield county shows that forest infestation is likely to persist in spite of control operations unless ornamental trees are kept uninfested. The best results in experiments in which infested pines 20–25 ft. in height received two applications of each of 3 insecticides on 22nd June and 2nd July were obtained with a mixture of lead arsenate and fish-oil, which gave 88 per cent. control [*cf.* **22** 394]. A single application has not hitherto given satisfactory results but might be more effective if properly timed.

The two most common native parasites of *R. buoliana* are *Ephialtes* (*Calliephialtes*) *comstocki*, Cress., and *Hyssopus thymus*, Gir., the latter being more common in collections made in the spring of 1935 from pine tips. A collection of 52 tips on 24th May 1935 contained 46 live

larvae and pupae of *R. buoliana* and 6 larvae parasitised by *H. thymus*, both adults and eggs of which were observed on this date. Parasitised larvae taken from a collection of tips from another locality on 6th June 1935 included 5 parasitised by *H. thymus*, 2 by *E. comstocki* and 3 by *Eurytoma tylodermatis*, Ashm. The only definite data (from another locality) shows parasitism of 8–12 per cent. in the last larval instar by *H. thymus*. Up to 19 individuals of this species have been reared from one host larva.

CHAPIN (E. A.). **Correct Name for Mexican Bean Beetle.**—*J. econ. Ent.* **29** no. 1 p. 214. Menasha, Wis., February 1936. [Recd. May 1936.]

In 1850 Mulsant described a series of six supposed new species of *Epilachna* in the following order : *varipes, murina, corrupta, varivestis, modesta* and *difficilis*. Of these Crotch in 1872 only recognised two species, grouping the first four under *varivestis* and the last two under *modesta*. In 1931 Korchefsky included all 6 species under *corrupta*. Since present evidence all points to the correctness of the views of both Crotch and Korchefsky as to the identity of *varivestis* and *corrupta*, according to Art. 28 of the International Code the name selected by the first reviser should be adopted for the Mexican bean beetle, namely *Epilachna varivestis*, Muls.

STARR (D.) & RICHARDSON (C.). **Toxicity of Dextro and Levo-Alpha-Para-Tolylpyrrolidine to *Aphis rumicis* L.**—*J. econ. Ent.* **29** no. 1 pp. 214–215, 1 ref. Menasha, Wis., February 1936. [Recd. May 1936.]

It has recently been shown that *dl*-nicotine is only about half as toxic to *Aphis rumicis*, L., as *l*-nicotine [*R.A.E.*, A **23** 5]. The toxicity of the optical isomers of α-p-tolylpyrrolidine, a compound related to nicotine, has now been studied with the same spraying technique. Sodium oleate, 0·25 gm. per 100 cc. solution, was added to the solutions of the compounds as a spreader and emulsifier, and the controls were sprayed with the sodium oleate solution alone. The sprays were prepared from the acid tartrate salts of the bases, the bases being liberated by a calculated amount of standard sodium hydroxide solution, and the requisite amount of sodium oleate was added to each. Tests showed that the sodium tartrate formed in the *l*-nicotine solutions by the reaction of the sodium hydroxide with the tartrate radical had no appreciable effect on the toxicity. The toxicities of the two isomers and those of the *l*-nicotine base and *l*-nicotine acid *d* tartrate are summarised in a table.

The dextro and laevo isomers of α-p-tolylpyrrolidine represent two types of toxicity. Near the point of 50 per cent. net mortality the dextro isomer appears to be as toxic as the laevo isomer, but at higher concentrations the mortality values for the laevo form are much higher. At the highest concentration tried (2·4 gm. base per 100 cc.) *l*-α-p-tolylpyrrolidine acid *l*-tartrate produced a constant mortality of 100 per cent., whereas *d*-α-p-tolylpyrrolidine acid *d*-tartrate produced an average mortality of only 58 per cent. (range 33–100 per cent.). It appears that *l*-nicotine acid *d*-tartrate may furnish a more convenient and more uniform standard of comparison for contact insecticides than *l*-nicotine, which has frequently been used for this purpose.

The salt is readily prepared by mixing 1 mole of *l*-nicotine with 2 moles of *d*-tartaric acid in 75 per cent. ethyl alcohol. It has the formula $(C_4H_6O_6)_2 \cdot C_{10}H_{14}N_2 \cdot 2H_2O$. The compound, when recrystallised two or three times from alcohol and air dried, is nearly 100 per cent. pure and keeps for months without change. It is solid, convenient to handle and readily soluble in water. When neutralised with sodium hydroxide (8·04 cc. 1·0 N solution per gm. of nicotine salt), the solution is practically identical in toxicity with free *l*-nicotine.

Hammer (O. H.). **An Outbreak of the Gooseberry Fruitworm and its Control with powdered Derris and Cubé Root.**—*J. econ. Ent.* **29** no. 1 pp. 215–216. Menasha, Wis., February 1936. [Recd. May 1936.]

Injury, in some cases severe, was caused by *Zophodia grossulariae*, Pack., in 1934 and 1935 to currants in New York. In experiments in 1935, insecticides were applied either when the blossoms were open, soon after all the calyces had closed, or after the first webs were formed by the larvae. Although some protection was afforded by applications of lead arsenate at the rate of 2, 3, 5 and 7 lb. and calcium arsenate at the rate of 2 and 4 lb. in 100 U.S. gals. water, control was in no case satisfactory, and lime-arsenate dusts (90 : 10 and 50 : 50) did not control the larvae. All arsenical dusts and sprays when used in quantities sufficient to reduce injury left excessive residues. Sprays of 3 lb. Kutane (cuprous cyanide) or 3–4 lb. natural cryolite in 100 U.S. gals. water gave fair control. The best results were obtained when two applications were made, the first when 60 per cent. of the calyces were still open and the second 6–8 days later. Nicotine compounds and powdered pyrethrum in spray or dust form were of little value.

Powdered derris and cubé [*Lonchocarpus*] root containing 5 per cent. rotenone gave good control when used in sprays, the best results being obtained with two applications at the rate of 2 lb. in 100 U.S. gals. water, one on 21st May and the next on 3rd June. One application of 4 lb. derris or cubé in 100 U.S. gals. water on 29th May, when the larvae were beginning to web the cluster together, gave almost as good results. Derris gave slightly better results than cubé when used in sprays. Dust mixtures containing either material to give 0·5 per cent. rotenone were slightly inferior to sprays. Both clay and talc proved satisfactory diluents.

Farrar (M. D.) & Flint (W. P.). **Injection Method for Dispersion of Oil into Tank Mixtures.**—*J. econ. Ent.* **29** no. 1 p. 216. Menasha, Wis., February 1936. [Recd. May 1936.]

It has been found that lead arsenate, when used in a spray mixture with lime, spreaders, Bordeaux mixture, etc., will partly stabilise finely divided oil particles if moderate agitation is maintained, and that untreated oils, or oils containing small amounts of products aiding their emulsification with water, can be dispersed, by a method called injection, into such a spray mixture. A small secondary suction controlled by one valve is attached to the pump suction, and the oil is drawn through the pump into the mixture after the other materials have been added to the tank. The pressure and pump action so disperse the oil as to produce about the same particle size as is obtained with a stock emulsion that may be poured into the tank, or with most of

the tank-mix emulsions. The method is also likely to prove useful in the preparation of dormant emulsions provided that a stabiliser is introduced into the water before the oil is injected. Stabilisers that show promise in making dormant oil sprays containing 2 U.S. gals. oil per 100 U.S. gals. include: 2 lb. soybean flour (5 per cent. oil content); 1 lb. casein with sufficient ammonia to dissolve; Bordeaux 1–1–100 or 8–8–100; or 1 lb. sulphonated alcohol.

Jones (T. H.). **Longevity of Adults of Elm Leaf Beetle.**—*J. econ. Ent.* **29** no. 1 p. 217. Menasha, Wis., February 1936. [Recd. May 1936.]

Adults of *Galerucella luteola*, Müll. (*xanthomelaena*, Schr.), collected in Massachusetts as they were leaving their hibernation quarters during May 1935, were taken to New Jersey and confined in 3-gallon glass jars into which fresh elm foliage was introduced from time to time. They continued to feed as late as 20th September, 10 were still alive on 10th October, and the last 2 died about 11th November. Numerous egg clusters were laid as late as the first half of August, and two were noted on 27th August. Eggs laid between 14th and 16th August hatched normally, the first larvae issuing on 21st August.

Dietrich (H.). **Elm Bark Beetles in New York State.**—*J. econ. Ent.* **29** no. 1 p. 217, 3 refs. Menasha, Wis., February 1936. [Recd. May 1936.]

Records based on scouting carried on throughout New York State in the autumn of 1934 and 1935 are given on the distribution of elm bark-beetles. All records are of adult beetles in the galleries. The localities specially covered were the borders of the State and the vicinities of basket factories where elm logs had been concentrated for many years. The beetles recorded are: *Hylastes* (*Hylurgopinus*) *rufipes*, Eichh., which was abundant wherever elms occurred; *Scolytus multistriatus*, Marsh., infestation by which spreads from New York City in all directions, but specially up the Hudson Valley; and *Scolytus sulcatus*, Lec., a beetle common on dying apple trees, which was found breeding on elm in three localities.

Dietrich (H.). *Scolytus sulcatus* **Lec. on Apple in New York State.**—*J. econ. Ent.* **29** no. 1 p. 217. Menasha, Wis., February 1936. [Recd. May 1936.]

Scolytus sulcatus, Lec., became very noticeable on apple in the Hudson Valley after the hard frost of 1933–34 and was common in the summer of 1935. It was not, however, found in the extensive apple sections of Lake Champlain and Western New York, although there were many dying apple trees.

Chamberlin (F. S.). **Comparative Toxicity of Dust Mixtures containing Derris and Cubé to the Tobacco Flea Beetle under Cage Conditions.**—*J. econ. Ent.* **29** no. 1 pp. 217–218. Menasha, Wis., February 1936. [Recd. May 1936.]

Experiments in which 75 adults of *Epitrix parvula*, F., were confined in each of 60 lantern globe cages were carried out in Florida to determine the comparative toxicity of derris and cubé [*Lonchocarpus*] dusts, which have shown promise for the control of this beetle on tobacco. One cage in each of 20 pairs received derris and the other cubé, with

a check cage for each pair, so that 1,500 beetles were subjected to each insecticide. By means of a precision duster, 80 mgm. of derris or cubé dust, containing 0·05 per cent. rotenone, with a total carbon tetrachloride extract of 0·2 per cent., was introduced into each cage through a vertical tube inserted at the base. A nearly neutral denicotinised tobacco dust of fine mesh was used as the diluent. The tops of the cages were covered with a rubber cloth during dusting, muslin being substituted as soon as the dust cloud had settled. Superficial observations indicated that mortality was primarily due to the introduction of dust into the alimentary tract while the beetles were cleaning their appendages. The average percentages of mortality in 24 hours were $85{\cdot}1 \pm 1{\cdot}2$ for the derris series, $85{\cdot}7 \pm 1{\cdot}4$ per cent. for the cubé series, and 0·5 for the controls.

Munro (J. A.). **Disease checks Bertha Army Worms.**—*J. econ. Ent.* **29** no. 1 p. 218. Menasha, Wis., February 1936. [Recd. May 1936.]

The Noctuid, *Barathra configurata*, Wlk., after an apparent absence of 6 years, became abundant and particularly destructive to flax in central North Dakota in 1935. Infestations in flax fields at the end of July were sometimes in excess of 200 larvae per sq. yd. By the first week in August disease had destroyed 90 per cent. of the larvae in fields where the population approximated 100 or more per sq. yd., but where the larvae were less numerous, the percentage of mortality from disease was lower. Cultures of an organism, the characteristics of which are given, were readily obtained from the visceral contents of the larvae. It agrees closely in all physiological and cultural characteristics with *Klebsiella capsulata*. At least one other instance of infestation of caterpillars by *Klebsiella* occurs in the literature.

Boyce (A.) & Prendergast (D. T.). **Dinitro-ortho-cyclohexylphenol offers Promise in Control of Citrus Red Mite.**—*J. econ. Ent.* **29** no. 1 pp. 218–219. Menasha, Wis., February 1936. [Recd. May 1936.]

In preliminary experiments in California, dinitro-ortho-cyclohexylphenol [*cf. R.A.E.*, A **24** 411], proved highly toxic as a contact dust to *Paratetranychus citri*, McG., including examples in the quiescent period prior to moulting, and an appreciable percentage of the eggs was also killed. This compound is soluble to the extent of about 2½ per cent. by weight in a petroleum oil of 90–95 per cent. unsulphonatable residue and to the extent of about 6 per cent. in one of 70–75 per cent. unsulphonatable residue. When used in solution in oil the toxicity of the compound to several insects studied and to *P. citri* is increased, and it is less likely to cause injury to *Citrus*. The most promising vehicle to carry the oil solution as a dust is a diatomaceous earth. To prepare the dust an amount of oil (with 5 per cent. by weight of the dinitro compound in solution) equal to 20 per cent. of the complete dust mixture is slowly atomised into a special mixing apparatus (in operation) which contains the diatomaceous earth. After 15 minutes of continuous mixing, the mixture is " fluffed " and is ready for use. The dust mixture contains 1 per cent. of the dinitro compound and possesses excellent adhesive qualities owing to the high oil content. It has given a high percentage mortality

of *P. citri*, *Aphis spiraecola*, Patch, *A. gossypii*, Glov., and crawlers of *Saissetia oleae*, Bern., and *Aonidiella* (*Chrysomphalus*) *aurantii*, Mask., all on *Citrus*.

Limited tests with the compound dissolved in oil and applied as a spray gave promising results against *P. citri* on *Citrus* and *Lecanium pruinosum*, Coq., on walnut. In laboratory tests encouraging results were obtained against the larvae of *Cydia* (*Carpocapsa*) *pomonella*, L., and *Eucosma* (*Tortrix*) *citrana*, Hb. In these tests the material appeared to act principally as a stomach poison, and its effectiveness does not seem to decrease rapidly upon exposure to atmospheric conditions. Injury to *Citrus* has been negligible even at relatively high dosages.

Pemberton (C. E.). **The Insect Vectors of Virus Diseases of Sugar Cane.**—*Proc. int. Soc. Sug. Cane Tech. 5 Brisbane 1935* pp. 118–120, 6 refs. Brisbane, 1936.

In view of the importance of Delphacids of the genus *Perkinsiella* in relation to the Fiji disease of sugar-cane, which is transmitted by *P. saccharicida*, Kirk., in Australia, *P. vastatrix*, Bred., in the Philippines, and *P. vitiensis*, Kirk., in Fiji [*R.A.E.*, A **21** 520; **22** 504], a list is given of the 23 known species of the genus, showing their distribution. Brief mention is also made of streak disease of sugar-cane, which is transmitted in South Africa by *Cicadulina mbila*, Naudé, but which has also been recorded in India, Egypt and Mauritius [*cf.* **24** 286]; sugar-cane mosaic, of which the only proved vector is *Aphis maidis*, Fitch; and the froghopper blight of sugar-cane found in Trinidad and Grenada, which is not due to a virus but to the feeding of *Tomaspis saccharina*, Dist.

Windred (G. L.). **Investigations on the Cane Beetle Borer,** *Rhabdocnemis obscura* **Boisd., and its Parasite,** *Ceromasia sphenophori* **Vill., in Fiji.**—*Proc. int. Soc. Sug. Cane Tech. 5 Brisbane 1935* pp. 358–378, 3 figs., 5 refs. Brisbane, 1936.

During 1933 and 1934, investigations were renewed in Fiji on the status of *Rhabdocnemis obscura*, Boisd., which causes large losses of sugar-cane annually in spite of control measures. A brief historical account is given of the borer in Fiji and of the damage done, which is likely to be greater when the cane is grown in wet regions. From 1921 to 1925 the total losses of sugar decreased, but even in 1925, 590 tons of recoverable sugar from a crop of 70,000 tons of sugar-cane was lost, exclusive of that in the cane discarded in the fields, which probably amounted to about 130 tons. From 1909 until 1923 there was a continual increase of the percentage of stalks injured. In 1933 and 1934 a systematic examination was undertaken of stalks taken at random from the crops arriving at the mills. The percentage of stalks damaged varied from 3 to 47, according to the district in which they were grown and the variety of cane. The differences in resistance to borer attack of the same variety of cane in various localities was not accounted for. The stalks of "Malabar," H 109 and "Badila" varieties were injured to the extent of 3, 16 and 21–47 per cent. respectively, and the same canes had an average number of 0·18, 1·25 and 0·82–3·75 borers per sample. The number of borers per acre varied from 720 to 15,000.

The Tachinid, *Ceromasia sphenophori*, Villen., which was introduced and released in 1910 and subsequently, and was recovered in one district in 1920, is now distributed throughout the cane fields, but does not control *R. obscura*. In the examinations in 1933–34, the percentage of parasitism varied from 0·06 to 13·62 and the average numbers of parasites per host from 1·50 to 2·85. Possible reasons for the failure of control by *C. sphenophori* include the action of predators [*cf. R.A.E.*, A **8** 25], adverse climatic conditions, and the effect of varieties of cane with heavy foliage in preventing the parasites from finding hosts. Among other methods of control that have been tried [*cf. loc. cit.*] are the burning of the standing crop or cane trash, and the use of resistant varieties of cane. It is recommended that further search should be made for other parasites.

Myers (J. G.). **Biological Control of Sugar-cane Pests in the British West Indies and British Guiana.**—*Proc. int. Soc. Sug. Cane Tech. 5 Brisbane 1935* pp. 381–385. Brisbane, 1936.

The author points out the value of basing biological control of pests in the American tropics on fundamental ecological investigations of the plant associations in which they occur in a primitive environment as well as under induced conditions. The primitive environment has proved to be the most promising source of efficient parasites. The soundness of these principles have been confirmed by the successful introduction of *Lixophaga diatraeae*, Tns., into St. Lucia, Antigua and St. Kitts from Cuba [*cf. R.A.E.*, A **23** 448 etc.], and of *Metagonistylum minense*, Tns., into British Guiana and St. Lucia from the lower Amazon [*cf.* **22** 566 etc.], both species against *Diatraea saccharalis*, F., on sugar-cane. In British Guiana, *M. minense* also attacked *D. saccharalis* on rice, of which it is the most serious pest. The Guiana cane lands appear to be ecological islands as promising as geographical islands for the biological control of pests. In the course of attempts to find a parasite for use against *Tomaspis saccharina*, Dist., on sugar-cane in Trinidad [*cf.* **23** 395] a Tachinid attacking *T. pubescens*, F., was discovered in the Kanaku mountains, in the interior of British Guiana. Another Tachinid, *Zenillia palpalis*, Aldr., is a parasite of *Castnia licoides*, Boisd., in the rain-forest of the Orinoco delta, where the native food plant is *Heliconia bihai* [*cf.* **24** 278].

Tucker (R. W. E.). **A Review of Control Work on *Diatraea saccharalis* F. in Barbados.**—*Proc. int. Soc. Sug. Cane Tech. 5 Brisbane 1935* pp. 386–397, 10 refs. Brisbane, 1936.

Work carried out in Barbados during the past 6 years on the biological control of *Diatraea saccharalis*, F., on sugar-cane by the liberation of colonies of the egg parasite, *Trichogramma minutum*, Riley, is outlined. The conditions under which the cane is grown in Barbados are briefly described, and the general results of the investigations are discussed critically. The detailed results are not given, having already been published [*R.A.E.*, A **23** 420, etc.].

Tucker (R. W. E.) & Wolcott (G. N.). **Parasite Introductions: Barbados and Puerto Rico.**—*Proc. int. Soc. Sug. Cane Tech. 5 Brisbane 1935* pp. 398–404. Brisbane, 1936.

Most of the information in this account of the exchange of natural enemies of pests of sugar-cane that has been made between Barbados

and Porto Rico since 1913 has already been noticed [*R.A.E.*, A **23** 713; **22** 699; **20** 612; etc.]. In 1933 and 1935 attempts were made to introduce *Hyperaspis trilineata*, Muls., into Porto Rico from Barbados for the control of sugar-cane mealybugs, but so far it has not been recovered in the field.

Moutia (L. A.). **The Sugar Cane White Grub** *Lachnosterna* (*Phytalus*) *smithi* **Arrow in Mauritius.**—*Proc. int. Soc. Sug. Cane Tech. 5 Brisbane 1935* pp. 436–445, 1 map, 1 graph, 8 refs. Brisbane, 1936.

The bionomics of *Lachnosterna smithi*, Arr., on sugar-cane in Mauritius are summarised [*cf. R.A.E.*, A **1** 28, etc.], and the damage and methods of control are discussed. Though infestation has spread yearly and now covers about 60 per cent. of the cane-growing area, its intensity has decreased, and only about 4,000 acres are damaged. Here the yield may be reduced from the normal 20 tons per acre to 4–6 tons. Control methods used since 1911 include hand collection of the adults, by which up to about 357 million beetles have been destroyed yearly, and of the larvae, which was abandoned in 1931 owing to the consequent destruction of the parasites; and the importation of parasites, of which the Scoliids, *Tiphia parallela*, Smith, from Barbados [*cf.* **5** 502] and *Campsomeris* (*Elis*) *coelebs*, Sich., from Madagascar, have become established, and *Campsomeris grandidieri*, Sauss., from Rodrigues [*cf.* **21** 424] has been recovered. These have proved inadequate, though more effective than cultural and insecticidal methods. The South African toad, *Bufo regularis*, which was introduced in 1922, has since multiplied in enormous numbers and sometimes destroys the adults of *Lachnosterna*, but, owing to the nature of its breeding places, does not seem likely to be of value in their control. The introduction of further parasites and predators and the production of cane varieties resistant to attack are recommended.

Wolcott (G. N.). **The White Grub Problem in Puerto Rico.**—*Proc. int. Soc. Sug. Cane Tech. 5 Brisbane 1935* pp. 445–456, 5 figs., 11 refs. Brisbane, 1936.

The history of the attempts to control white grubs on sugar-cane in Porto Rico by means of parasites [*cf. R.A.E.*, A **11** 60; **23** 114] and of the success eventually obtained with the imported toad, *Bufo marinus* [*cf.* **21** 235; **22** 155], is reviewed. Brief notes are given on the species of white grubs present on the Island [*cf.* **15** 409], including *Lachnosterna portoricensis*, Smyth, and *L. vandinei*, Smyth, which comprise 90–99 per cent. of the population, and against which the only effective chemical measure is the application of carbon bisulphide emulsion to the soil.

Mungomery (R. W.) & Buzacott (J. H.). **Control of the "Greyback Cane Beetle"** (*Lepidoderma albohirtum* **Waterh.) in North Queensland.**—*Proc. int. Soc. Sug. Cane Tech. 5 Brisbane 1935* pp. 456–464, 1 fig., 2 refs. Brisbane, 1936.

Methods of controlling *Lepidoderma albohirtum*, Waterh., on sugar-cane in northern Queensland are discussed. Soil fumigation with carbon bisulphide alone or mixed with an equal amount of para-dichlorobenzene [*cf. R.A.E.*, A **19** 235; **24** 273] when the larvae are

in the second or third instar is efficient, but cannot be effected when the soil is water-logged and must therefore be delayed until after the monsoon rains, during which the larvae are already doing much damage. Unless fumigation is undertaken over a wide area, fumigated fields quickly become reinfested. Collecting the adults or larvae by hand is expensive and unsatisfactory, and the destruction of trees on which the adults feed is only of value in certain circumstances. As native parasites and predators exert little control, the toad, *Bufo marinus*, which has practically eliminated white grubs in Porto Rico [**22** 155], was introduced in 1935 [*cf.* **24** 274].

Mungomery (R. W.) & Buzacott (J. H.). **A preliminary Study in Trapping " Greyback " Cane Beetles.**—*Proc. int. Soc. Sug. Cane Tech. 5 Brisbane 1935* pp. 464–469, 1 fig. Brisbane, 1936.

In spite of intervening drought that decreased the beetle population [*R.A.E.*, A **24** 273], experiments on trapping adults of the cane beetle [*Lepidoderma albohirtum*, Waterh.] feeding on *Ficus benjamina* by means of a light-trap [**23** 266] were carried out in Queensland during 1934 and 1935. In two localities, where the beetles emerged early and late respectively, a trap was set up at a distance of 20–30 ft. from the tree, which was then shaken. The beetles that fell to the ground generally flew up to the trap after about a minute. When they were numerous the hum made by their wings appeared to incite the beetles that were still on the trees so that they flew direct to the light. This did not occur when the beetles were too few to cause a noticeable hum. Comparative tests showed that good results were obtained from trapping only when the tree was shaken, though the proportion of gravid females caught was lower. When the trees were shaken, the approximate numbers of beetles caught per night ranged from 1,300 to about 16,000 in the area of early emergence and from 200 to 10,000 in the area of late emergence, during 1934. In 1935 fewer were caught. The sexes were taken in about equal numbers. Fewer beetles were trapped in moonlight periods. The beetles did not respond to light traps placed in the cane fields instead of near trees. They were more easily shaken from the trees when they had fed extensively than when they were starting to feed.

Box (H. E.). **The Species of *Diatraea* attacking Sugar Cane in the New World.**—*Proc. int. Soc. Sug. Cane Tech. 5 Brisbane 1935* pp. 470–476, 2 refs. Brisbane, 1936.

The classification and synonymy of the species of *Diatraea* attacking sugar-cane in America, and the ecological distribution and biological control of some of them are briefly reviewed from the literature [*cf. R.A.E.*, A **19** 376 ; **23** 744 ; **24** 22, etc.]. A list is appended of the 12 most important species, with brief notes on their geographical distribution and other food-plants.

Hinds (W. E.) & Osterberger (B. A.). **Recommendations for Control of the Sugar-cane Borer in Louisiana.**—*Proc. int. Soc. Sug. Cane Tech. 5 Brisbane 1935* pp. 476–483, 7 refs. Brisbane, 1936.

In recent years control measures have reduced the losses caused to sugar-cane by *Diatraea saccharalis*, F., in Louisiana to considerably

less than the average for 1915–1925 of 20 per cent. of the crop. The geographical and climatic conditions in southern Louisiana are described, and it is pointed out that unusually dry winters are frequently followed by an increase in damage and wet winters by a decrease, probably because of the drowning of a larger proportion of larvae hibernating in cane top trash on the ground. Minimum temperatures below 20°F. also cause a high mortality among the larvae. Recommendations for control include cutting out the dead hearts when the first generation are active ; the destruction of infested maize before the first generation moths have emerged ; biological control by means of *Trichogramma minutum*, Riley [*cf. R.A.E.*, A **22** 579], which has to be renewed each year since *D. saccharalis* hibernates only in the larval stage, and the eggs of no other host species are present in cane areas ; the use of uninfested seed cane ; the application of a dust of light sodium fluosilicate in early July if many eggs of the second generation hatch [*cf.* **18** 65] ; cutting the cane at or below ground level to prevent the larvae entering hibernation ; and general cleaning up and burning of the cane trash [*cf.* **22** 653].

McDougall (W. A.). **Wireworms (Elateridae) and their Control in Queensland Sugar-cane Fields.**—*Proc. int. Soc. Sug. Cane Tech. 5 Brisbane 1935* pp. 583–587, 3 figs., 2 refs. Brisbane 1936.

An account is given of the bionomics and control of the chief species of wireworms that attack sugar-cane in central and southern Queensland [*cf. R.A.E.*, A **23** 202 ; etc.]. Species recorded in addition to those already noticed are *Lacon variolus*, Cand., *Conoderus* (*Monocrepidius*) *australasiae*, Boisd., which was taken in Bundaberg only, where it infests well drained fields, and two unidentified species. The adults of *L. variabilis*, Cand., and *Heteroderes carinatus*, Blkb., oviposit in the soil of both cultivated fields and grassland under similar conditions. In their earlier instars, the larvae of *L. variabilis* require excessively wet soil for survival whereas those of *H. carinatus* only require moderately moist soil. The older larvae of both species can withstand varying soil conditions. They mature under similar conditions in the laboratory, but in the field the larvae of *L. variabilis* are confined mostly to low, badly-drained land and those of *H. carinatus* to well-drained land. Thus, the establishment of a population of *L. variabilis* depends on soil moisture, and the amount of rain in mid-summer is correlated with the extent of damage in the following season. In land brought under cultivation for the first time or after an interval of many years *L. variolus* may be found associated with *L. variabilis*, but in subsequent plantings it disappears as the adults prefer to oviposit in uncultivated land. If new badly-drained fields are drained as early as November before planting to eliminate infestation by *L. variabilis*, the ploughing will control *L. variolus*.

Mungomery (R. W.). **A short Note on the Breeding of *Bufo marinus* in Captivity.**—*Proc. int. Soc. Sug. Cane Tech. 5 Brisbane 1935* pp. 589–591, 2 figs., 2 refs. Brisbane, 1936.

Since the toads (*Bufo marinus*) brought from Hawaii to Queensland [*cf. R.A.E.*, A **24** 196, 379] against *Lepidoderma albohirtum*, Waterh., arrived in the cold dry winter months, it was decided to keep them in captivity until the wet season began in November or

December. A pond was built of concrete with a shallow marginal area and deep centre, and planted to simulate natural conditions. The pond and its immediate surrounding were enclosed in an octagonal wooden framework covered with wire netting. The toads were placed in the pond on 24th June and eggs were found among the water weeds on 1st July immediately after two days of warm wet weather. The tadpoles hatched on 4th July.

VEITCH (R.). **Entomological Research in Queensland.**—*J. Aust. Inst. agric. Sci.* **2** no. 1 pp. 3–7. Sydney, March 1936.

An account is given of the organisation of the entomological branch of the Department of Agriculture and Stock, Queensland, and of the researches being carried out at the four field stations attached. These are at present primarily concerned, respectively, with white grubs attacking grassland (*Paspalum*), cotton pests, pests of *Citrus* and the banana thrips [*Scirtothrips signipennis*, Bagn.], and pests of deciduous fruits, particularly the Queensland fruit-fly [*Dacus ferrugineus*, F.] and the codling moth [*Cydia pomonella*, L.]. The activities of these stations are co-ordinated at the Brisbane headquarters, where also research is carried out on more general problems. All stations are organised so that they can be transferred to other localities as the problems in each locality are solved. Brief reference is made to entomological research work in Queensland by other institutions.

FYFE (R. V.). **The Biological Control of *Clidemia hirta* in Fiji.**—*J. Aust. Inst. agric. Sci.* **2** no. 1 pp. 8–9. Sydney, March 1936.

The history of the biological control of *Clidemia hirta* by *Liothrips urichi*, Karny, in Fiji is briefly reviewed. The thrips, which was introduced in 1930 [*R.A.E.*, A **18** 616], so weakens the weed that the competing vegetation is able to overrun it [*cf.* **21** 625, etc.]. In one locality where the weed had to be cut every six months, cutting is now required once in two years, and only where grazing has been heavy. Weeding costs have been reduced by 75 per cent.

TAYLOR (G. G.). **Application of Orchard-Sprays. I. The Stationary System. II. The Portable Spraying-System.**—*N.Z. J. Agric.* **51** no. 6 pp. 321–329; **52** nos. 1 & 3 pp. 34–38, 172–174, 11 figs., 3 refs. Wellington [N.Z.], 1935–36.

The types of equipment used in the stationary and portable systems of spraying orchards in New Zealand are described. The care and management of the apparatus, methods of applying the sprays, and the advantages and disadvantages of the two systems are briefly discussed [*cf. R.A.E.*, A **15** 182].

KANGAS (E.). **Die Braunfleckigheit des Birkenholzes und ihr Urheber *Dendromyza* (*Dizygomyza*) *betulae* n. sp. Vorläufige Mitteilung.** [The Brown Fleck of Birchwood and its Cause, *D. betulae*, sp. n. Preliminary Communication.]—*Commun. Inst. for. fenn.* **22** no. 1, 31 pp., 14 figs., 2 pp. refs. Helsinki, 1935. (With a Summary in Finnish.) [Recd. May 1936.]

The literature on brown fleck in deciduous trees is surveyed. From 1933 to 1935 investigations were made in Finland on brown fleck in

birch. Small birch trees infested by larvae were placed in the laboratory and in all cases a new species of *Agromyza* (*sens. lat.*), which the author describes from the adult, larva and pupa as *Dendromyza* (*Dizygomyza*) *betulae*, sp. n., or its parasite, *Symphya ringens*, Hal., was bred out. It or its parasite occurred also in 10 tin cylinders placed round birch trees in nature. There were other Diptera in the cylinders, but only once did another Agromyzid occur, an example of *A.* (*Liriomyza*) *flaveola*, Fall.

The adults of the new Agromyzid usually appear in the first half of June, ovipositing about mid-June in the young, tender shoots of birch. The eggs are laid singly. The larva bores into the cambium, leaving a small hole, which turns brown. On reaching the stem it makes a crooked mine downwards fairly rapidly (sometimes covering about 6 feet in a fortnight) till it reaches the base, when it leaves the stem in order to pupate in the ground. In young birches, 6–18 ft. high, it may mine to and fro in the base until it becomes full-grown. On falling to the ground it enters the litter, soon pupating there or in the ground beneath. Pupation takes place in August, and the adult emerges in the following summer.

Symphya ringens was bred in abundance from the pupae. It is possible that the occurrence of flecks in some annual rings and their absence in others may be due to control by this Braconid. It probably oviposits in the larva of the host. Only one parasite emerged from each host pupa. In Finland brown fleck occurs in other trees as well as in birch, being general in willow and aspen.

Bovien (P.) & Jørgensen (M.). **Fortsatte Undersøgelser over Angreb af Snudebiller** (*Apion*) **i Kløverhoveder.** [Further Investigations of Attacks of *Apion* spp. in Clover Heads.]—*Tidsskr. Planteavl* **41** pp. 337–353, 3 refs. Copenhagen, 1936. (With a Summary in English.)

Investigations on clover weevils of the genus *Apion* in Denmark [*cf. R.A.E.*, A **23** 197] were continued in 1935. Some of the adults of *A. apricans*, Hbst., that had oviposited in 1934 hibernated a second time and oviposited again in the following summer. As a few were still alive on 15th December 1935, it is probable that a third hibernation may occur. The numbers of eggs laid by females in the laboratory varied widely, the maxima being 222 for *A. apricans* and 217 for *A. assimile*, Kirby. The average is probably rather more than 50. Repeated applications of a dust consisting of 80 per cent. Cryocide (natural cryolite), 15 per cent. talc and 5 per cent. sticker greatly reduced the numbers of *A. flavipes*, Payk., and *A. apricans* in treated field plots, but spraying with Cryocide and a spreader was not so effective in the field as in the laboratory, where 80–85 per cent. mortality was obtained with strengths varying from 1 to 1·3 per cent.

Conflicting views as to the part of the clover plant attacked by the larvae of *A. virens*, Hbst., are discussed [*cf. loc. cit.*]. Adults collected on clover in the field on 15th May were placed on clover plants in the insectary. Four days later eggs were found deeply buried in the midribs of the leaves. By 3rd June most of them had hatched, and the larvae were mining in the leaf stems, moving toward the axils. If the plants were small, the larvae eventually penetrated to the roots, but in large well-developed plants they remained in the aerial portions. On 1st July full-grown larvae and some pupae were present, and

adults began to emerge on 6th July, starting to feed 3 days later. On the basis of these observations, the view that *A. virens* hibernates in the stems in the larval stage is erroneous. Notini [**23** 625] came to the same conclusion in respect of *A. varipes*, Germ., in Sweden, and maintains that the life-history of the mining species closely resembles that of the species developing in the flower heads.

HERFS (A.). **Oekologisch-physiologische Studien an *Anthrenus fasciatus* Herbst.**—*Zoologica* **34** Lief. 1–2 pp. 1–96, 5 pls., 93 refs. Stuttgart, 1936.

This monograph presents the results of a detailed study of the ecology and physiology of *Anthrenus fasciatus*, Hbst., a shorter account of which has already been noticed [*R.A.E.*, A **22** 189]. Sections are devoted to feeding habits, the effect of temperature, humidity and light on development and the effect on moulting of such factors as sex, food, temperature and moisture.

SEITZ (A.). *Leptinotarsa decemlineata.*—*Ent. Rdsch.* **53** no. 12 pp. 161–166. Stuttgart, 8th February 1936.

In view of the possibility of the potato beetle, *Leptinotarsa decemlineata*, Say, being introduced into Germany, the author discusses psychological means for teaching the general public to recognise this pest. He suggests that sweets should be made and coloured to represent the beetle.

COWLAND (J. W.). **The Sorghum Midge in the Anglo-Egyptian Sudan.**—*Ann. appl. Biol.* **23** no. 1 pp. 110–113, 1 pl., 2 refs. Cambridge, February 1936.

Total or partial sterility of the heads of *Sorghum caudatum* (dura) in the Blue and White Nile Provinces of the Anglo-Egyptian Sudan has often been attributed to the Pentatomid, *Agonoscelis versicolor*, F., or meteorological causes, but in 1930 A. W. Punter pointed out that the damage was due to Cecidomyiid larvae, and this has now been confirmed. The species concerned has been identified as *Contarinia sorghicola*, Coq., which causes similar injury to *Sorghum* in the United States [*R.A.E.*, A **17** 86]. All the stages, which are briefly described, can be found in the field from late September to late December. Adults from the resting generation emerge during the latter part of the rains. Oviposition takes place when the anthers are still enclosed within the spikelets or as soon as they extrude. The eggs are laid, usually singly, in the spikelets on the inner wall of the glumes or between the pales. The larvae feed on the developing grain; as many as three have been known to mature in a spikelet, but one is sufficient to cause the abortion of the grain in it. The shrivelled grain and pales become stained red. The larvae pupate in the spikelet, and the adults emerge a few days later. The females, which are generally more numerous than the males, are most active in the morning. In late December or early January the larvae spin cocoons in the spikelet, where they remain until the following season.

No damage has been noticed on *Sorghum* that flowers before mid-September, but it is sometimes very severe on late-sown *Sorghum* and varieties that tiller heavily after that time. In most years the heads of the main crop practically escape injury, but sometimes,

especially when much resowing has been carried out, a large proportion may be rendered more or less sterile. On late tillering shoots half of the heads of those flowering in October and all of those maturing in November may be sterile. The amount of damage varies from year to year and, to some extent, with the variety, but the crop is often reduced by 25 per cent. The grass, *S. halepense*, is also attacked.

MARSHALL (Joseph). **The Distribution and Sampling of Insect Populations in the Field with special Reference to the American Bollworm, *Heliothis obsoleta* Fabr.**—*Ann. appl. Biol.* **23** no. 1 pp. 133–152, 4 figs., 9 refs. Cambridge, February 1936.

An important part of the investigations on the control of cotton pests carried out in Barberton, South Africa, comprises observations of fluctuations in insect populations, and this paper records the results of such studies with regard to the oviposition of *Heliothis armigera*, Hb. (*obsoleta*, F.) on maize. The following is the author's summary: The problem associated with estimation of insect activity is discussed. A precision experiment, undertaken to investigate the nature of the egg-laying of the American bollworm is described. The nature of the distribution is investigated. Correlation trials between the two counts show that the same portions of the crop retain their relative attraction to the bollworm moth over short periods. The effect of subdivision of the area on the sampling error is analysed. Both egg as well as plant number figures per 3-yard length show a greater variation between than within rows. Correlation and regression coefficients prove a very close relationship between plant number and eggs laid. Eliminating the effect of plant number eliminates this greater variation for the first egg-count figures. In the second count the variation between rows is still significantly greater. The reason for this is discussed. Considerations affecting the sampling technique developed from the precision data are discussed. The sampling method is explained and two examples are given. From the analysis of these the system is shown to sample adequately the fields and fulfils the requirements of the survey.

DU PLESSIS (C.). **Outbreaks of the Brown and Red Locusts in the Union during the 1934–35 Season.**—*Fmg in S. Afr.* 1936 pp. 10–14, 7 maps. Pretoria, January 1936. [Recd. May 1936.]

There was a very heavy locust infestation in the Union of South Africa during the period under review. Swarms of *Locustana pardalina*, Wlk., invaded a large area in the Union, South-West Africa and the southern part of the Bechuanaland Protectorate in May–July 1934 and oviposited throughout it, with the result that by November about 300,000 square miles were infested with hoppers. The adults of the new generation began to migrate, mainly in a northward direction, in late December, and the numbers of the remaining locusts were considerably reduced by migratory locust birds (*Sphenorhyncus* and *Glareola*), as well as indigenous birds. A migration of swarms from South-West Africa and the Kalahari into the Union developed in March–August 1935, but the infestation was less serious than in 1934.

During the winter of 1934 the swarms of *Nomadacris septemfasciata*, Serv., were present mainly in the eastern half of the Union, but in November there was a heavy influx of ovipositing swarms from the

north, which penetrated as far south as Humansdorp by January 1935. Egg-laying was general throughout the affected part of the Union as well as in South-West Africa and the Bechuanaland Protectorate, so that a very heavy hopper infestation was expected. Owing, however, to a drought in December and January, which resulted in the desiccation of large numbers of eggs, and to destruction by egg parasites, especially *Stomatorrhina lunata*, F., the hopper outbreak was not heavy and less severe than in the previous year. The surviving hoppers became adult in March, and in spite of new swarms coming from the north, the swarms were less numerous than in the preceding season; their numbers were further reduced by poison dusting from aircraft in northern Zululand.

Smit (B.). **The Red Locust Invasion of the eastern Cape Province during 1935.**—*Fmg in S. Afr.* 1936 reprint no. 6, 2 pp. Pretoria, January 1936. [Recd. May 1936.]

An account is given of the invasion of *Nomadacris septemfasciata*, Serv., in eastern Cape Province, where it appeared in December 1934 after an absence of 30 years. The locusts showed great preference for maize, as well as for *Citrus*, which they seemed likely to damage severely. Many *Citrus* orchards were saved from destruction by driving the locusts off the trees by day and spraying with poison [sodium arsenite] by night. Later on, a poison bait made up of 4 parts sawdust to 1 part bran, moistened with diluted poison and scattered at the rate of 10–20 lb. per acre was very successful. Spraying the trees with lime-sulphur was effective in repelling the locusts for 2–3 days only, and a new type of a flame-thrower, using a mixture of sawdust and sulphur burned in a cloud from a rotary dusting machine, did not prove very destructive.

As a result of control, comparatively little actual damage was caused to *Citrus*. By the end of February 1935, practically all the locusts had disappeared, the remainder being extensively parasitised by red mites and Nematodes, and by the middle of March the invasion was over. Enormous numbers of eggs were laid all over the eastern Cape Province, but most of them perished owing to the drought [*cf.* preceding abstract].

Ramchandra Rao (Y.). **A Report on the Work done by the Research Staff under the Locust Research Entomologist to the Imperial Council of Agricultural Research at Karachi during the Year 1935.**—Med. 8vo, 102 pp. New Delhi, Govt India Press, 1936.

An account is given of both extensive and intensive field studies on *Schistocerca gregaria*, Forsk., ph. *solitaria* in British Baluchistan and in the Sind–Rajputana area in 1935, and the distribution and breeding of *Schistocerca* throughout the year are discussed and correlated with meteorological data. The results of this work and of a biometrical study of specimens collected have already been noticed [*R.A.E.*, A **24** 236]. Since in winter the locust population practically vanishes in the Indian Desert area and increases along the Mekran coast, while the reverse occurs in the summer, it appears that the two areas are complementary to one another, and that there is an exchange of population between them according to the season.

Experimental work was carried out at Pasni under semi-natural conditions. Three consecutive generations were bred between February

and November. The length of the incubation period varied inversely with soil temperature ; thus it lasted 29½ days when the temperature of the sand at a depth of 4 ins. was 21–26°C. [69·8–78·8°F.] and only 13 days when it was 28–39°C. [82·4–102·2°F.]. The moisture of the sand at this depth was about 4 per cent. When newly moulted adults were given different diets, sexual maturation and oviposition were reached most rapidly by those fed on *Sorghum* (16·75 and 22·5 days), while fresh *Heliotropium undulatum*, which is prevalent in the "reks" [*cf.* **22** 121], and fresh *Cyperus arenarius* also appeared to accelerate maturation.

Tabulated records of the numbers of locusts observed during the surveys are appended.

Cardoso (J. G. A.). **Ainda sôbre os inimigos do gafanhoto vermelho.** [More on the Enemies of *Nomadacris septemfasciata*.]—*Moçambique Docum. trim.* no. 4 pp. 105–113, 2 pls. Lorenzo Marques, December 1935. [Recd. May 1936.]

In continuation of the account of the natural enemies of *Nomadacris septemfasciata*, Serv., in Portuguese East Africa [*R.A.E.*, A **24** 3], the various stages of a fungus, *Sterigmatocystis* sp., found on specimens from Bárue, where many locusts were dying from an unknown cause, are figured and described. The locusts fed on food containing the spores died a few days later, and it seems probable that this fungus was responsible for the epidemic.

Gregarina locustae was encountered, for the first time in Mozambique, infesting locusts of a swarm that passed Moamba in October 1935.

King (K. M.), Paul (L. C.), Glen (R.) & Berg (V. L.). **Summary of Saskatchewan Grasshopper Infestations Autumn 1935 and Ratings of probable Outbreaks 1936.**—*Saskatoon Leafl. Ent. Br. Canad. Dep. Agric.* no. 42, 78 pp. multigraph. Ottawa, March 1936.

For the planning of forthcoming grasshopper campaigns, the estimation of an existing infestation should be as quantative as possible in methods and terms of expression, but that of the severity of the probable future outbreak must depend on the judgment of the forecaster and his knowledge of conditions determining the degree of survival of the eggs.

By the system adopted in Canada, a quantitative survey of the abundance of adult grasshoppers is undertaken as soon as possible after the migration and local dispersal in order to define the infested areas. The survey of egg-pod abundance by counting the number of egg-pods per unit of area is started as soon as egg-laying begins, but part of the surveying in each district is left until oviposition is almost complete. Before the next season's outbreak can be estimated, the quantitative data have to be reduced to common terms. An allowance is made for the number of viable eggs and natural enemies entering hibernation by adjusting earlier observations on the basis of the final egg-counts obtained in the same locality. In addition, the average size of the egg-pods and the frequency of roadside egg-beds are duly considered. In preparing the ratings of probable severity of the next season's outbreak, a distinction is made between the infestations in the stubble fields, where the type of agricultural practice is of great importance, and the infestations outside the crop-lands

in sod and ditches. The type of soil is very important, particularly in stubble fields, heavy soils being able to sustain approximately twice as dense an infestation as light soils without involving greater potential injury to crops.

The methods of calculating the ratings of probable severity of outbreaks under different conditions modifying it are shown; the probable infestation is graded as very severe, severe, moderate and light, and the areas so rated require respectively 8–10, 5–7, 2–4, and ½–1 lb. dry bait per seeded acre.

The tabulated results of the survey in Saskatchewan for the autumn of 1935, and ratings of the probable outbreak in 1936 are given.

ANDREWARTHA (H. G.). **Some Notes on the Breeding Grounds of the Plague Grasshoppers in South Australia.**—*J. Dep. Agric. S. Aust.* **39** no. 8 pp. 1031–1035, 1 map. Adelaide, March 1936.

A preliminary survey of the possible breeding areas of *Austroicetes* sp. and *Chortoicetes terminifera*, Wlk., in December 1935 and January 1936 showed that in the north-eastern pastoral district, the bands and loose swarms of *C. terminifera*, consisting of the apparently ph. *dissocians* progeny of the 1935 swarms, and the numerous isolated non-gregarious individuals were found in creek beds or low lying areas, and never occurred in the blue bush (*Kochia*) and salt bush (*Atriplex*) complex. In the Gawler Ranges pastoral district, this species was found in undulating areas with small, ill-defined creek beds or swamps, and on land that had been cleared for wheat and allowed to revert, but did not occur on the level grassy flats typical of the country.

The permanent breeding grounds of *C. terminifera* apparently lie to the north, west and east of the Gawler Ranges district, which was invaded by swarms in October–November 1933. The progeny of these swarms hatched in March 1934 and gave rise to another generation by August. Thus, there were two generations in this country, which formed an important intermediate breeding area, immediately preceding the peak of the outbreak.

NEWMAN (L. J.). **Red-legged Earth Mite** (*Halotydeus destructor* **Tucker**).—*J. Dep. Agric. W. Aust.* (2) **13** no. 1 pp. 49–54, 6 figs. Perth [W.A.], March 1936.

Halotydeus destructor, Tucker, caused unusual damage to young wheat in Western Australia during the autumn and winter of 1935–36. There was sufficient rain to bring up the crops and to hatch the eggs [*cf. R.A.E.*, A **23** 149], but in the subsequent drought the weeds died, and the mites migrated from them to the wheat and oats, which were the only green plants left. In normal seasons with continuous growth, the crop would have outgrown the injury, but under the existing conditions of depleted strength the damage was considerable. The eggs laid by these mites remained dormant until sufficient rain fell later to hatch them.

This mite usually infests clover, and it is particularly destructive in the south and south-west of the State. The eggs hatch at the same time as the clover seeds germinate, and the mites attack the seedlings. By mid-June a large winter generation is produced. When badly attacked, the young clover turns yellow and often dies, and the mite then migrates to potatoes, peas and seedlings of garden flowers

and vegetables. Since clovers, which constitute 80 per cent. of the pasture in some districts, are particularly subject to attack by this mite, the lucerne flea [*Smynthurus viridis*, L.] and the clover weevil, and at the same time are not a complete ration for the cattle, it is suggested that more mixed pastures should be established. Cereal crops are not usually attacked, except for oats, which appear to outgrow the pest. Measures that have been used for the control of *H. destructor* are briefly discussed [*cf.* **19** 141 ; **22** 547, etc.].

Insect Pests and their Control.—*Agric. Gaz. N.S.W.* **47** pt. 4 pp. 214–218, 4 figs. Sydney, 1st April 1936.

The pests in New South Wales dealt with in this part of a series [*cf. R.A.E.*, A **24** 211, etc.] include a mite infesting figs and similar to one recorded in California in 1922 [*cf.* **10** 250] ; *Rhoecocoris sulciventris*, Stål, on *Citrus* [*cf.* **23** 396] ; and *Leptops squalidus*, Boh., which infests orange and deciduous fruit trees. The eggs of *L. squalidus* are laid on the leaves, and the larvae drop to the ground and attack the roots. The adult weevils, which emerge from mid-June to November, mostly in September, crawl up the trunks and feed on the foliage. The damage to the leaves is less important than that to the roots, which, in the case of deciduous trees, is confined to the roots in the subsoil. With a deep surface soil the general health of the tree suffers ; when the surface soil is 1–1½ ft. deep the limbs of the tree die back ; when the surface soil is shallow and of poor quality the tree may die although the lower limbs tend to make growth. Trees should be banded in late June, some sticky material being applied in a ring 3 ins. wide and ⅛ in. thick as high up the trunk as possible. The branches of the trees should not touch the weeds and grass, or the weevils may reach the leaves without being caught in the bands. The weevils that concentrate below the bands should be collected frequently and destroyed.

Jack (H. W.). **Summary Record of Entomological Work in Fiji.**—*Agric. J. Fiji* **8** no. 1 pp. 18–22. Suva, 1935. [Recd. May 1936.]

A brief review is given of the development of work on economic entomology in Fiji since its commencement in 1905 and particularly that done on coconut pests and their biological control from 1919 onwards.

Simmonds (H. W.). **Fruit Fly in Fiji.**—*Agric. J. Fiji* **8** no. 1 pp. 22–23. Suva, 1935. [Recd. May 1936.]

The most important insects attacking fruit in Fiji are Trypetids of the genus *Dacus* (*Chaetodacus*) and the fruit-piercing moths, *Othreis fullonia*, Cl., and its allies. The larvae of *Othreis* feed on *Erythrina* sp., which should be destroyed when near orchards. The two commonest Trypetids are *D.* (*C.*) *passiflorae*, Frogg., and *D.* (*C.*) *xanthodes*, Broun, both of which attack *Citrus*, guava, papaya and other fruits, the former also cotton bolls and the latter pineapples. A third species, allied to *D.* (*C.*) *distinctus*, Mall., of Samoa, has been captured in Suva, but its habits are unknown. The numbers of Trypetid larvae in the fruits rapidly increased with the advent of the guava season, but as it advanced, the Lygaeid, *Germalus pacificus*, Kirk., appeared on the

trees in great numbers and destroyed the eggs. As a result guavas were free from infestation for most of July and August, though other fruits were still being attacked.

As the native Braconid parasites, *Opius* sp. and *Biosteres* sp., attack the larvae through the skin of the fruit and so can only reach those lying near the surface, a small consignment of *Tetrastichus giffardianus*, Silv., which enters the damaged fruit in search of its host, was introduced from Hawaii. It bred readily in the laboratory on both the Fijian Trypetids, the original colony of 10 increasing to 12,000 in 4 months. Colonies are being distributed as rapidly as possible, and in one locality a parasitism of 20 per cent. has already been obtained.

SIMMONDS (H. W.). **Entomological Notes.**—*Agric. J. Fiji* **8** no. 1 p. 32. Suva, 1935. [Recd. May 1936.]

An outbreak on coconuts of *Levuana iridescens*, B.-B., early in 1935 was quickly suppressed by the introduced Tachinid, *Ptychomyia remota*, Aldr., and one of *Promecotheca reichei*, Baly, reported from Vanua Balavu appears to be under control by parasites. During the year colonies of the following beneficial insects were despatched overseas: *Teleonemia lantanae*, Dist., which attacks *Lantana*, to the New Hebrides and New Caledonia; *Tetrastichus giffardianus*, Silv. [see preceding paper] to the New Hebrides, western Samoa, New South Wales and New Caledonia; and *Apanteles tirathabae*, Wlkn., and *Nemeritis palmaris*, Wlkn., both parasites of *Tirathaba trichogramma*, Meyr., to western Samoa. Larvae of *Papuana huebneri*, Frm., are causing serious damage to taro [*Colocasia*] on Tarawa, Gilbert Islands. This Dynastid was previously known from New Britain.

PARHAM (B. E. V.). **Mycological Notes—Mortality in Larvae of *Teleonemia lantanae*.**—*Agric. J. Fiji* **8** no. 1 p. 31. Suva, 1935. [Recd. May 1936.]

An entomogenous fungus of the genus *Hirsutella* was found in October 1935 attacking fifth instar nymphs and adults of *Teleonemia lantanae*, Dist., a Tingid introduced into Fiji for the control of *Lantana crocea* [*cf. R.A.E.*, A **22** 269, etc.]. This would partly account for the high rate of mortality periodically suffered by *Teleonemia* [*cf.* next paper].

FYFE (R. V.). **The Lantana Bug in Fiji.**—*Agric. J. Fiji* **8** no. 1 pp. 35–36. Suva, 1935. [Recd. May 1936.]

The marked seasonal variation in the effect of *Teleonemia lantanae*, Dist., on *Lantana* in Fiji observed over a period of 5 years by H. W. Simmonds is discussed. During the warmer and wetter parts of the year, when the Tingids are concentrated on the inflorescences, the plants appear to be much less severely attacked than in winter, when the colonies feeding on the leaves cause more spectacular damage. Adverse climatic and biotic factors appear to work at maximum intensity during the summer months, the most important being the Lygaeid, *Germalus pacificus*, Kirk., which is present on *Lantana* all the year round, reaching maximum numbers when the flowers and fruit are more abundant. As it, too, feeds on them, it comes into direct contact with nymphs of *Teleonemia* during this season. It is

also predacious on the nymphs of *Brachyplatys pacificus*, Dall., and on a species of *Pseudococcus* that occurs in small numbers on *Lantana* in the neighbourhood of Suva. Other natural enemies observed attacking *Teleonemia* include adults of *Coccinella repanda transversalis*, F., and larvae of *Hemerobius* sp., though these predators seldom occur on *Lantana*, and the fungus, *Hirsutella* sp. [see preceding paper]. Torrential rains often knock heavily infested leaves to the ground, where the nymphs soon die.

Moutia (A.). **The Commoner Insect Pests of Orchards, Vegetable and Flower Gardens in Mauritius.**—*Bull. Dep. Agric. Mauritius* Gen. Ser. no. 44, 39 pp. Réduit, Mauritius, 1935. [Recd. May 1936.]

This bulletin contains short notes on about a hundred of the more common insect pests in Mauritius, showing their food-plants and in some cases including a brief description of the injurious stage and measures for control. The insects are arranged according to orders, and there is a chapter on general methods of control, and the preparation and uses of insecticides. Lists are appended showing the food-plants of each insect, and the pests of each plant.

Vinson (J.). **Les Coccinelles des Iles Mascareignes.**—*Rev. agric. Maurice* no. 85 pp. 19–28, 1 pl. Port Louis, 1936.

This revision of the Coccinellids of Mauritius, Réunion and Rodriguez includes 14 species, most of which are predacious on Aphids or Coccids.

Jepson (W. F.). **The Development of Biological Control of Insect Pests, with special Reference to some current Experiments.**—*Rev. agric. Maurice* no. 84 pp. 188–192; no. 85 pp. 29–34. Port Louis, 1935–36.

This is a general review of the theory of the biological control of insect pests and some of the cases in which this has been successfully applied, with notes on the possibility of further importations of parasites into Mauritius.

Oosthuizen (M. J.). **Carnation Worm Investigations.**—*Fmg in S. Afr.* 1936 reprint no. 7, 2 pp., 1 ref. Pretoria, January 1936.

Injury to carnations by *Epichorista ionephela*, Meyr. [*cf. R.A.E.*, A **14** 232; **19** 410] was unusually severe near Pretoria in 1935. Infestation appears to depend on climate, being serious in dry seasons, and it is extremely localised. In 6 fields it ranged from 5 to 95 per cent., and one crop was reduced from 1,000–2,800 dozen flowers a week to about 160 dozen. Injury by a thrips, which becomes noticeable in June and increases till late August, was a contributing factor.

In tests on the attractiveness of coloured lights to the moths, white, blue and red hurricane lanterns (2 of each colour) were suspended about 5 yards apart and 2 ft. from the ground above buckets of water in a severely infested field. On 8 consecutive nights the lamps were lighted at sunset and extinguished at sunrise. Of a total of 864 moths captured, the white, blue and red lights attracted 56·7, 33·2 and 10 per cent. respectively. The blue paint used to colour the lantern globe subdued the light somewhat. Of these moths, 21·8 per cent. were

females, of which 73·3 per cent. were gravid. The average number of eggs in a female was 165. The greatest activity of the moths occurred early in the evening ; 360 of 396 moths caught on 3 consecutive nights were attracted before 10 p.m. The cost of maintaining such traps 12 yards apart for 300 nights during the year is estimated at £1 15s. per 1,000 plants.

Other mechanical methods of control in use included the cutting out and destruction of infested shoots, stems and plants. Sprays of lead or calcium arsenate, sodium fluosilicate, natural cryolite, or derrisol, applied with a spreader, were not effective.

A Chalcid was reared from a pupa of this Tortricid, and 2 species of Braconids parasitised from 10 to 25 per cent. of the larvae.

DU PLESSIS (C.). **The Maize Stalk-borer.**—*Fmg in S. Afr.* 1936 reprint no. 14, 2 pp., 1 fig. Pretoria, February 1936.

Busseola fusca, Fuller, is the most serious pest of maize in South Africa, causing an average annual loss estimated at £300,000, or 10 per cent. of the crop. Points in the life-history to be considered in devising control measures are : the females apparently prefer to oviposit on the oldest plants in the early season and on the youngest ones in the late season [*cf. R.A.E.*, A **19** 56] ; the larvae enter the open tops of the maize plants and subsequently migrate from plant to plant ; they hibernate in the part of the maize plant underground. The system of control recommended is outlined. Trap blocks of early planted maize are distributed through maize sown at the ordinary date and are treated by top dressing with derrisol [**22** 79, etc.] and cutting and destruction of the infested plants as soon as the larvae appear. If necessary, late planted blocks are treated as trap blocks in autumn. When maize-growing is sufficiently intensive, early cutting and ripening in the stook is practised to prevent the larvae finding winter quarters, and where cattle are available, the whole of the plants are grazed down. The number of larvae surviving the winter may be reduced by winter and early spring ploughing, or where this is not possible stump grubbing is of great assistance. When the rains fall early, part of the infestation may be avoided or concentrated over a shorter period by delayed planting, thus facilitating summer control measures. When ploughing rains fall late, a portion of the infestation is in any case missed, the effect being the same as that secured by delayed planting. Attempts to attract moths to different colours and intensities of light and to various odours have proved unsuccessful, and trap cropping by means of narrow strips instead of blocks fails to concentrate the population sufficiently.

HARRIS (W. V.). **Cotton Uprooting and Burning.**—*Ent. Leafl. Dep. Agric. Tanganyika* no. 13, 3 pp. Dar-es-Salaam, March 1936.

The annual destruction of cotton plants and crop residues, on dates specified for the different districts, is compulsory in Tanganyika. This is of particular importance for the control of *Platyedra gossypiella*, Saund., as it has no resting stage in the Territory, but also attacks *Hibiscus esculentus* and *H. sabdariffa* (which are included in the regulations for cotton destruction). Under these conditions fumigation of the seed is useless, and control depends on the elimination of food-plants for an annual interval of two months (the maximum time for

the completion of the life-cycle). Although *P. gossypiella* has not yet reached the western provinces these measures are necessary to reduce damage by other pests.

VRIJDAGH (J. M.). **Contribution à l'étude de la maladie des chancres des tiges du cotonnier causée par** *Helopeltis bergrothi* **Reut.**—*Bull. agric. Congo belge* **27** no. 1 pp. 1–37, 8 pls., 2 figs., 18 refs. Brussels, March 1936.

In this paper on the damage to cotton shoots by the feeding of *Helopeltis bergrothi*, Reut., in the Belgian Congo, the author summarises information contained in a previous one [*R.A.E.*, A **23** 99] and records the results of further histological studies of the lesions produced. He concludes that the symptoms in the cotton plant are due to the emission of an irritant fluid by the Capsid in the act of feeding.

HEGH (E.). **Les termites.**—36 pp., 31 figs. Brussels, Minist. Colon. Dir. gén. Agric., 1935. Price *Fr.* 3. [Recd. May 1936.]

This account of the distribution and bionomics of termites and the damage caused by them is compiled from a previous monograph [*R.A.E.*, A **10** 570].

[BEKKER (É.)] **Беккер (Э.). Die Mundwerkzeuge des** *Tetranychus telarius* **(L.) und deren Funktion in Beziehung zur chemischen Bekämpfung des letzteren.** [The Mouth-parts of *T. telarius* and their Function with Regard to the Question of the chemical Control of the Mite.] [*In Russian.*]—*Zool. Zh.* **14** no. 4 pp. 637–654, 10 figs., 8 refs. Moscow, 1935. (With a Summary in German.)

A detailed description is given of the mouth-parts of *Tetranychus telarius*, L., and their function is discussed. It is concluded that sucking is effected through a puncture in the leaf, and not from its surface, so that the mite would not be affected by stomach poisons. A study of its tracheal system, which is briefly described, indicated that respiratory poisons designed to penetrate through the tracheae would be useless unless they also had a contact action on the tissues.

[YAKUBOVA (F. Kh.).] **Якубова (Ф. Х.). Der Kampf ums Dasein bei der Schildlaus** *Chionaspis salicis* **L.** [The Struggle for Existence in the Scale, *C. salicis*.] [*In Russian.*]—*Zool. Zh.* **14** no. 4 pp. 712–718, 17 figs., 3 refs. Moscow, 1935. (With a Summary in German.)

Investigations on the effect of overcrowding on *Chionaspis salicis*, L., confirmed those made by Smirnov and Polezhaev on *Lepidosaphes ulmi*, L. [*R.A.E.*, A **23** 138].

[YAKUBOVA (F. Kh.).] **Якубова (Ф. Х.). Körpergrösse und Fruchtbarkeit der Schildlaus** *Lepidosaphes ulmi* **L.** [The Size of the Body and the Fertility of the Scale *L. ulmi*.] [*In Russian.*]—*Zool. Zh.* **14** no. 4 pp. 719–721, 2 figs. Moscow, 1935. (With a Summary in German.)

Observations showed a marked correlation in females of *Lepidosaphes ulmi*, L., between the length of the scale and the number of

eggs produced. The increase in fertility with length was greater in scales of small to average size than in larger ones. The size of the eggs was constant, except in the case of very small scales.

[Zolotarev (E. Kh.).] **Золотарев (Е. Х.). Die Existenzbedingungen und die individuelle Variabilität der Wanderheuschrecke.** [Conditions of Existence and individual Variability in the Asiatic Locust (*Locusta migratoria*, L.).] [*In Russian.*]—*Zool. Zh.* **14** no. 4 pp. 722–736, 15 refs. Moscow, 1935. (With a Summary in German.)

From the biometric study of series of *Locusta migratoria*, L., obtained in different years and localities in the northern Caucasus, and from a survey of biometrical data on this species available in Russian literature [*cf. R.A.E.*, A **16** 486 ; **19** 334, 335] and their comparison with ecological conditions under which the swarms occurred [*cf.* **15** 231 ; **17** 139], it is concluded that whenever the conditions under which the locusts exist approach the optimum, the tendency to individual variation among them increases. When conditions deteriorate, as during unfavourable years or on the margins of the distribution areas, the populations of locusts become more uniform, the individuals deviating in any direction from the norm being probably eliminated by various factors.

[Smaragdova (N. P.).] **Смарагдова (Н. П.). Heat and Cold Resistance of the Grain Weevils and the Grain Mites in Relation to the Temperature of their Development.** [*In Russian.*]—*Zool. Zh.* **14** no. 4 pp. 737–748, 6 graphs, 2 refs. Moscow, 1935. (With a Summary in English.)

A detailed account is given of tests in Moscow on the resistance to heat and cold of female grain mites, and to heat of the grain weevils, *Calandra granaria*, L., and *C. oryzae*, L., all these having been bred at temperatures of 20 and 30°C. [68 and 86°F.] and at 100 per cent. humidity. At 42°C. [107·6°F.] some of the mites were killed in 5 minutes, but some survived for 30. Those that had been reared at 30°C. proved to be considerably more resistant than those reared at 20°C. A dry atmosphere increased the rate of mortality due to heat. Resistance to temperatures of —8–9°C. [17·6–15·8°F.] and —15–16°C. [5–3·2°F.], for periods of from 30 minutes to 5 hours was also greater in mites reared at 30°C. than in those reared at 20°C., but no difference was shown in tests at 2°C. [35·6°F.] with exposures of 5–21 days.

The heat resistance of the grain weevils was tested at 45°C. [113°F.], since at higher temperatures a large percentage rapidly succumbed. The exposures lasted for from 5 to 25 minutes. As it was found that some apparently dead weevils were able to revive after a few days, the death rate was ascertained 6–7 days after the experiment. Under these conditions, *C. granaria* proved more resistant to heat than *C. oryzae*, the percentage of weevils bred at 20°C. that died after 25 minutes exposure being 56 and 80 respectively, and the corresponding figures for those bred at 30°C. being 54 and 74. After 5 minutes exposure, 3 per cent. of *C. granaria* were killed in both cases, and none of *C. oryzae*, but at longer exposures the death rate of the latter species was invariably higher and weevils reared at 30°C. were more resistant.

[Zimin (L. S.).] **Зимин (Л. С.). Key for determining the Egg-pods of Acrididae.** [*In Russian.*]—76 pp., 30 figs. Leningrad, All-Union Inst. Plant Prot. 1935.

The general structure of Acridid egg-pods is discussed, and a key to and descriptions of the egg-pods of the Acridids of the Russian Union are given.

[Borkhsenius (N. S.).] **Борхсениус (Н. С.). Five new Species of Scales (Coccidae) morphologically allied to San José Scale (*Aspidiotus perniciosus* Comst.).** [*In Russian.*]—*Plant Prot.* 1935 no. 6 pp. 127–133, 7 figs. Leningrad [? 1936].

A key is given to *Aspidiotus perniciosus*, Comst., and 11 species of Coccids that occur in the Russian Union and are sometimes mistaken for it. They include 5 new species, which are described in Russian and English, *viz.* : *A. alma-atensis* on apples and hawthorn (*Crataegus*) in south-eastern Kazakstan ; and *A. caucasicus*, *A. multiglandulatus* and *A. armenicus* on poplars and *A. turanicus* on willow, all in Transcaucasia.

[Troitzkiĭ (N. N.) & Shchegolev (V. N.).] **Троицкий (Н. Н.) и Щеголев (В. Н.). Ed. Key to the Injuries of cultivated Plants.** [*In Russian.*]—Demy 8vo, 528 pp., 178 figs., 281 refs. Moscow, Gosud. Izd. kolkhozn. sovkhozn. Liter. [St. Publ. collect. Fmg Lit.], 1934. Price *Rub.* 6.50 ; binding *Rub.* 1. [Recd. April 1936.]

This text-book, to which 15 authors have contributed, is intended for the use of agricultural experts in the Russian Union and is divided into five parts. The first (pp. 9–48) contains general information on the importance and bionomics of insect pests and on the methods of estimating their abundance, the amount of the damage caused, and the rate of parasitism. Notes are also given on the use of the keys.

The second part (pp. 49–397) consists of keys to Coleopterous and Dipterous soil pests, the different stages of *Gryllotalpa gryllotalpa*, L., and the larvae of cutworms, and to the insects attacking cereals, pulse crops, oil producing and textile plants, vegetables, medicinal plants, small fruits and deciduous fruit trees, and vines. Both Russian and scientific names of the plants and pests are given.

The third part (pp. 398–512) comprises keys to Hymenopterous parasites attacking pests of field crops, vegetables and orchards, respectively.

The fourth part (pp. 513–523) is a bibliography of the more important literature, practically all Russian, and the fifth part (pp. 524–528) consists of a list of the chief cultivated plants in the Russian Union, arranged by families, and giving both Russian and scientific names.

[Ulashkevich (M. I.).] **Улашкевич (М. І.). Nodule Weevils of the Species *Sitona lineata* L. and *Sitona crinita* Hbst.** [*In Ukrainian.*]—*Vinnitz'ka obl. s.-g. dosl. Sta.* [Vinnitza reg. agric. Exp. Sta.] no. 23, 75 pp., 9 figs., 7 diagr., 8 refs. Kiev, 1935. [Recd. April 1936.]

A detailed account is given of the bionomics of *Sitona lineata*, L., and *S. crinita*, Hbst., as observed in 1930–34 in a district in western

Ukraine, where they cause severe damage to leguminous plants. Their distribution in the Russian Union is briefly discussed and all stages are described. Some of the information given is similar to that already noticed [*R.A.E.*, A **23** 191, etc.]. The adult weevils are chiefly attracted to young sprouting plants and are especially active at night ; warm rain accelerates their activity at any time. Females that have hibernated under deep snow appear in the spring with developed ovaries and a large reserve of fat-body, whereas those that have sheltered in exposed places with but little snow and revived during warm spells of weather have immature ovaries and a small amount of fat-body. It was found that the former lay twice as many eggs as the latter. The maximum number of eggs produced by a female was 1,011 for *S. lineata*, and 338 for *S. crinita*. The number of eggs laid per day is greatly affected by the food, more eggs being laid by *S. lineata* when fed on pea leaves and by *S. crinita* when fed on lentils. When oviposition was more intense, however, the life of the female was shorter. About 85 per cent. of the eggs laid in places exposed to the sun dry out, and if the weather is dry and hot, 50–60 per cent. may fail to hatch even in the shade. In the second half of May the egg stage lasted 11–14 days at 18–24°C. [51·8–57·2°F.]. Upon hatching the larvae make their way into the soil, where they feed on the nitrogen-collecting nodules on the roots of peas, lentils and vetch. Clover is little attacked and the development of the larvae on it is retarded. The larval stage usually lasts 30–42 days and the pupal 9–13, but pupae have been found as early as June and as late as October. Upon appearing on the surface of the soil, the young adults disperse in search of food in fields of peas, lentils and vetch, and after these crops have been harvested, migrate to cultivated and wild perennial leguminous plants, and some to fields of beet or autumn-sown cereals. They feed actively until the end of August and then begin to enter hibernation in the soil or under fallen leaves, moss, etc. In experiments, overwintered weevils that were taken on the 21st March and had not yet fed lived without food for 49 days, and most of the young individuals taken on 25th July survived until 25th October, but weevils taken in the second half of April after they had already fed on peas were killed by starvation in less than a month.

Only 6–8 per cent. of the weevils were killed by the Braconids, *Pygostolus falcatus*, Nees, and *Perilitus labilis*, Ruthe, and other parasites ; about 10–15 per cent. of those in fallow land and clover fields were destroyed by spiders ; and about 45 per cent. of the adults of *S. crinita* that hibernated in thick moss were killed by a fungus in 1931. A bacterial disease infected up to 31 per cent. of the larvae in June 1931 and 15–25 per cent. in July 1933. Many of the larvae, chiefly those in the upper layers of moist soil, were killed by a muscardine fungus in 1933.

The damage caused to leguminous plants by the adults and the larvae is discussed. In the case of peas, plants sown early were less infested. Those grown in fields that in the preceding year were under maize, which uses up a considerable amount of nitrogen present in the soil, were more infested than those grown after barley or beet. Of the annual leguminous crops, vetch suffers most, as it attracts both species ; then follow peas, which are chiefly attacked by *S. lineata*, and lentils, which are preferred by *S. crinita*. Both these species also fed on lucerne and sainfoin, and to a less extent on clover, sugar-beet, soy beans and other plants. The effect of the damage

caused to the foliage on the development and yield of peas is discussed in detail. The damaged plants were shorter and produced fewer pods and lighter seeds.

Control measures suggested by various workers are critically reviewed. Those recommended include the cultivation of summer crops at some distance from the perennial leguminous plants, deep ploughing to kill the pupae and young beetles in the soil, and the use of strips of clover and lucerne as trap crops on which the weevils can be destroyed by mechanical means or by insecticides. On the basis of experiments, various insecticides are recommended for this purpose and for use on the main crops, but the most effective were sprays of 1 per cent. sodium fluosilicate or sodium fluoride. These poisons were also the best of those used in dust form. Considerable numbers of weevils may also be killed at harvest or after ploughing by poisoned baits of freshly mown lucerne, etc., sprayed or dusted with an insecticide. Since the weevils often shelter in sheaves of harvested peas, all the remains left from threshing should be destroyed. Agricultural methods of control should include crop rotation, proper cultivation and manuring, early sowing, and the choice of early maturing varieties.

Flachs (K.). **Krankheiten und Schädlinge unserer Gespinstpflanzen.** [Diseases and Pests of German Fibre Plants.]—*Nachr. Schädl-Bekämpf.* **11** no. 1 pp. 6–28, 13 figs., 3 pp. refs. Leverkusen, March 1936. (With Summaries [unpaged] in English, French and Spanish.)

In view of the increasing cultivation of flax and hemp in Germany consequent on the reduced imports of cotton, the author surveys from the literature the more important diseases and pests that have been recorded as attacking these crops in Germany and neighbouring countries.

Kotte (W.). **Pflanzenschutz im deutschen Maisbau.** [Plant Protection in German Maize Cultivation.]—*Nachr. SchädlBekämpf.* **11** no. 1 pp. 28–39, 11 figs., 1 p. refs. Leverkusen, March 1936. (With Summaries [unpaged] in English, French and Spanish.)

This paper deals in some detail with the smut fungus, *Ustilago zeae*, and the Pyralid, *Pyrausta nubilalis*, Hb., which are the chief pests of maize in Germany. Information on *P. nubilalis* has already been noticed [*R.A.E.*, A **22** 465, etc.].

Klinger (H.). **Die insektizide Wirkung von Pyrethrum- und Derrisgiften und ihre Abhängigkeit vom Insektenkörper.** [The insecticidal Action of Pyrethrum and Derris Poisons and their Dependence on the Insect Body.]—*Arb. physiol. angew. Ent. Berl.* **3** nos. 1–2 pp. 49–69, 115–151, 2 pls., 2 figs., 4 pp. refs. Berlin, 18th March & 4th May 1936.

In view of the conflicting and indefinite nature of statements in the literature, the investigations reported on here were made to ascertain the action of pyrethrum and derris on various insects, the results being compared with those obtained by previous workers. Chief attention was paid to the nature of the toxic action and its dependence on the anatomy, age and stage of development of the

insect and on physiological factors. The technique employed is described. The experimental insects were chiefly Lepidoptera, the species being selected to represent degrees of receptivity to the poisons ranging from great sensitiveness to great resistance. Other insects and spiders were used in individual physiological experiments.

The general course of poisoning is described for both poisons, used as sprays and dusts on fourth-instar larvae. Pyrethrum extract produced a higher mortality as a spray than as a dust, apparently because of closer contact. The most sensitive larvae were those of *Bombyx mori*, L., *Vanessa io*, L., and *Smerinthus ocellatus*, L. A second group comprised *Nygmia phaeorrhoea*, Dön. (*Euproctis chrysorrhoea*, auct.), *Dendrolimus pini*, L., *Porthetria* (*Lymantria*) *dispar*, L., and a sawfly, *Diprion* (*Lophyrus*) *pini*, L. Still less sensitive were *Lymantria monacha*, L., *Stilpnotia salicis*, L., and *Euxoa* (*Agrotis*) *segetum*, Schiff., and the greatest resistance was in a fourth group, comprising *Barathra* (*Mamestra*) *brassicae*, L., *Hyponomeuta malinellus*, Zell., and *Cydia* (*Carpocapsa*) *pomonella*, L. In all groups, but especially in the second and third, the last instar was much more resistant than the fourth. *B. mori* was extremely sensitive and is therefore unsuitable for testing pyrethrum. In the experiments with derris, rotenone was used in dust and spray forms and powdered derris roots as a dust with talc as the carrier. As with pyrethrum, the first group proved the most sensitive, but it was remarkable that the second and third groups proved highly resistant to both rotenone and derris. Derris produced a greater mortality than could be explained by its rotenone content, so that its other constituents merit attention.

Experiments with both poisons on the effect of temperature confirmed Gosswald's conclusions regarding pyrethrum [*R.A.E.*, A **22** 345]. Mortality was higher with a low air humidity than with a high humidity. Control would be more successful in weather cooler than the vital optimum, the longer time required at a low temperature for death to ensue being apparently merely due to retardation of metabolism.

The existence in any given species of an individual variation independent of external influences was shown by the fact that with identical conditions some larvae succumbed, while the remainder completed development normally. This individual variation decreased in the older instars.

Much of the discrepancy in results in experiments with pyrethrum and derris is due to loss of toxicity, which can occur easily in esters saponified in alkaline solvents. The author found that pyrethrin emulsions in sealed bottles exposed to light lost about 80 per cent. of their efficiency in 3 days, so that a fresh spray solution had to be made up for each experiment. With dusts, talc being the carrier, no reduction of efficiency was noticed after long exposure to light.

The course of poisoning after application of the poison to various parts of the insect body and examinations made to determine the toxic action in the body showed that pyrethrins are nerve poisons, while rotenone and the other poisons in derris roots act by hindering the utilisation of oxygen in the cell tissues and cause death by a gradual internal suffocation. The differences in sensitivity in the various stages and species are to a certain extent physiological and anatomical, depending on the insect body. Sensitivity depends largely on the cuticle and its permeability, and on the constitution of the nervous

system and sense organs of the skin. It also seems to have some connection with the hydrogen-ion concentration of the body fluid. The combined action of morphological, anatomical and physiological factors govern sensitivity or resistance to poison. Both pyrethrum and, to a greater degree, derris poisons in sublethal doses had a noticeable effect on the subsequent larval instar and on the pupal and adult stages. Both poisons will prove important substitutes for arsenic in plant protection work, but their use in Germany is likely to be limited owing to their chemical instability, especially in storage, and the fact that they have to be imported.

Bryant (G. E.). **A new Species of *Epitrix* (Halticinae) injurious to Tobacco in Brazil.**—*Arb. physiol. angew. Ent. Berl.* **3** no. 2 p. 114. Berlin, 4th May 1936.

Epitrix nicotianae, sp. n., is described from adults found feeding on tobacco in São Paulo.

Paillot (A.). **Nouveau type de maladies à polyèdres ou polyédries observé chez les chenilles d'*Euxoa* (*Agrotis*) *segetum* Schiff.**—*C. R. Acad. Sci. Fr.* **202** no. 3 pp. 254–256, 2 refs. Paris, 1936.

The author describes at length a third type of disease [*cf. R.A.E.*, A **22** 227 ; **24** 78] in the larvae of *Euxoa segetum*, Schiff., which causes a comparatively slight mortality among them.

Bruneteau (J.). **Les traitements aux arbres fruitiers dans le Sud-Ouest en 1935.**—*Rev. Zool. agric.* **35** no. 1 pp. 1–12. Bordeaux, 1936.

This paper includes brief notes on the effects of sprays on various pests of fruit trees in south-western France in 1935, but deals chiefly with the question of timing their application against *Cydia pomonella*, L., on apples and pears. The overwintered larvae pupated about 30th April and 2nd May in two localities, and the first adult females laid eggs in the field and laboratory about 6th May. There were three peak periods of emergence of this generation, 8th–15th May, 25th May and the largest about 15th–20th June. Oviposition took place at irregular intervals, probably because of the temperature. First generation pupae were found on 18th June and the first adults at the end of June in two localities. The presence of adults of both the overwintered and first generations accounted for the large number of eggs that were laid between 2nd and 11th July. The females of the first generation continued to oviposit until the end of July, and the first adults of the second generation emerged from 10th to 15th August. The larvae hatching from the eggs laid in early July were responsible for 10–32 per cent. of infested pears in one locality. In two others where sprays had been applied on 15th and 17th July, respectively, 5–6 and 59 per cent. of the pears contained larvae about 1 week old. In a fourth locality the percentage of infested apples varied from 60 to 80. An Order of 22nd July authorised the application of arsenical sprays up to 2 months before harvest, so that fruit maturing in September can be treated but not that ripening in July and August. When arsenical sprays were applied to apple and pear trees in five

orchards according to the standard programme at petal-fall stage (5th–27th April) and again 2 and 5 weeks later, the percentage of infested fruit varied from 6 to 60 according to the variety, whereas in two orchards sprayed on 5th and 8th July almost complete control was obtained.

MARTIN (H.). **The Scientific Principles of Plant Protection with Special Reference to Chemical Control.**—2nd edn, Demy 8vo, xii + 379 pp., London, E. Arnold & Co., 1936. Price 21*s.* net.

The second edition of this book differs little in plan from the first [*R.A.E.*, A **17** 17], but the developments of the subject (particularly of epidemiology and laboratory work on insecticides and fungicides) in the last eight years have necessitated the revision and re-writing of the greater part.

FRYER (J. C. F.), GIMINGHAM (C. T.) & BUCKHURST (A. S.). **Report on Insect Pests of Crops in England and Wales 1932–1934.**—*Bull. Minist. Agric. Fish.* no. 99 v + 50 pp., 1 map, 208 refs. London, H.M.S.O., 1936. Price 1*s.*

This bulletin records briefly the incidence of the more important agricultural and horticultural pests in England and Wales during the three years 1932–34. It differs from the previous one [*R.A.E.*, A **21** 534] in that the major part consists of a summary in tabular form of reports and records of the different pests. Chapters dealing with developments in methods of control and introduced pests are included, numerous references being given concerning the subjects discussed.

STANILAND (L. N.) & BEAUMONT (A.). **Twelfth Annual Report of the Department of Plant Pathology for the Year ending September 30th, 1935.**—*Pamphl. Seale-Hayne agric. Coll.* no. 46, 32 pp. Newton Abbot, Devon, 1936.

Pests that caused considerable damage in Devon and Cornwall during the year included : *Tipula* spp. on cereals, grassland, lettuce and broccoli ; *Apion* spp. and *Sitona* spp., on clover ; *Tetranychus telarius*, L., on strawberries ; *Tarsonemus approximatus* var. *narcissi*, Ewing, on narcissus ; and *Phorbia* (*Chortophila*) *brassicae*, Bch., and *Aleurodes brassicae*, Wlk., on crucifers. Heavy dressings of naphthalene did not prevent damage to broccoli by the cabbage stem flea-beetle [*Psylliodes chrysocephala*, L.], which continues to be troublesome. Wireworms attacked young tomato plants in a greenhouse on land that had been broken up from pasture 2 years previously, but watering the plants with a solution of mercury bichloride checked the damage and the plants matured. Young anemone plants were so severely attacked by cutworms that large areas had to be replanted. Baits of Paris green and bran [*cf. R.A.E.*, A **23** 621] gave good results where they were put down early enough. Owing to the dry summer, violets were so badly attacked by *Tetranychus telarius* that in some places the plants had to be stripped of their leaves and sprayed four times. Pests that have not been recorded in the previous 11 years were the Coccid, *Lichtensia viburni*, Sign., on ivy, and *Rhyacionia buoliana*, Schiff., on young trees of *Pinus insignis*.

LYSAGHT (A. M.). **A Note on the Adult Female of *Anguillulina aptini* (Sharga), a Nematode parasitising *Aptinothrips rufus* Gmelin.**—*Parasitology* **28** no. 2 pp. 290–292, 1 fig., 5 refs. Cambridge, March 1936.

A brief description is given of the appearance and reproductive system of the adult female of *Anguillulina* (*Tylenchus*) *aptini*, Sharga, which parasitises *Aptinothrips rufus*, Gmelin, in Britain [*R.A.E.*, A **20** 488]. If slight pressure be applied to the abdomen of an infested thrips, young Nematodes of both sexes are often extruded from the anus. Fertilisation apparently takes place in the free-living stage, and many of the thrips were found to contain a single adult female. Both larvae and pupae were also found to be infested. A post-nuptial moult occurs when the female has entered the body cavity of the host.

FLEURY (A. C.). **Report[s] of Insect and Other Animal and Plant Disease Interceptions at California Plant Quarantine Inspection Points for 1933 & 1934.**—*Spec. Publ. Calif. Dep. Agric.* no. 131, 57 pp.; no. 134, 66 pp. Sacramento, Calif., 1935. [Recd. May 1936.]

Lists are given of the insect pests intercepted in California in 1933 and 1934, showing the plants, etc., with which they were associated and the country of origin, together with brief notes on the more important ones [*R.A.E.*, A **22** 533; **23** 700].

MACKIE (D. B.). **Progress in Insect Eradication Programs in California.**—*Spec. Publ. Calif. Dep. Agric.* no 137, pp. 39–44. Sacramento, Calif., 1935. [Recd. May 1936.]

A brief account is given of the history of the occurrence of and the measures undertaken to eradicate *Dialeurodes citri*, R. & H. [*cf. R.A.E.*, A **20** 173], *Chrysomphalus obscurus*, Comst. [*cf.* **23** 699], and *Lepidosaphes halli*, Green, which are potentially serious pests of *Citrus*, walnuts and stone fruits, respectively, in California. In 1934 limited work was carried out against *Coccus elongatus*, Sign., which was present on a few trees [*Ceratonia siliqua*], and *Parlatoria pergandei*, Comst., on *Citrus* [**23** 699]. Work may also be undertaken against *P. oleae*, Colv. (olive scale), which was recorded for the first time in California in 1934 [**23** 527].

D. citri, which is polyphagous, was first discovered in California in Yuba country in 1906 [*cf.* **16** 193] and in Los Angeles county in 1928, and from these centres it spread to the Sacramento valley and to 12 foci in the south [*cf.* **22** 532]. During 1935–36, spraying against it will be confined to certain localities in Los Angeles and Yuba counties. Treatment is discontinued when it has not been found for 3 consecutive years during which spraying has been carried out, but inspection is continued for 3 more years. The infestation of *L. halli* discovered in 1934 [**23** 700] was confined to species of *Prunus* (including *Amygdalus*) in and close to the Plant Introduction Gardens of the United States Department of Agriculture at Chico. It was not found on trees of about 30 other genera inspected. All food-plants sent out in 1934 were destroyed, and all those sent out during the past 10 years were inspected, but no other record of infestation was found. Trees not needed for propagation were destroyed, and the branches of the rest cut back and treated with oil and fumigated with hydrocyanic acid

gas by the pot method (5 oz. sodium cyanide per 100 cu. ft.). All budwood used during the year was either vacuum fumigated or dipped in oil and all stock fumigated. Up to the end of February 1935 no known infestation remained to be treated.

KEIFER (H. H.). **Insect Taxonomy.**—*Spec. Publ. Calif. Dep. Agric.* no. 137 pp. 50–56. Sacramento, Calif., 1935. [Recd. May 1936.]

The value to the economic entomologist of the correct determination of specimens and of a natural system of classification of insects is discussed.

GOULD (G. E.). **Insect Pests of Mint.**—*Circ. Purdue Univ. agric. Exp. Sta.* no. 211, 8 pp., 5 refs. Lafayette, Ind., April 1935. [Recd. May 1936.]

Brief notes are given on the bionomics and control of insect pests of mint in Indiana, the most injurious being *Longitarsus waterhousei*, Kutsch. (mint flea-beetle). This Halticid occurs in the north of Indiana and is spreading eastwards. Peppermint (*Mentha piperita*) is the preferred food-plant, but spearmint (*M. spicata*) is also attacked. The damage is mostly due to the larvae [*cf. R.A.E.*, A **19** 205], which hatch in mid-May and feed for about a month on the roots of the mint. The pupal stage lasts 8–20 days, the peak of adult emergence occurs in late July, and oviposition begins about 1st August. If much soil is taken with mint roots when planting new fields, the latter may become infested by means of transported eggs and larvae. In 1934, the mint in most of the fields in Indiana was killed by a late frost, and resetting continued up to late July. The new plants were severely injured by the larvae already present in the soil, and the crops were poor. For control, frequent crop rotation and the elimination of wild mint round the field are advised. A dust of calcium arsenate with 5–10 per cent. bentonite or dusting clay at the rate of 15 lb. per acre, or a 50 per cent. dust at the rate of 25 lb. per acre, applied between 20th July and 5th August, gives satisfactory results. After the mint is harvested, Paris green with flour [*cf.* **23** 483, etc.] may be used. Barium fluosilicate gave good control in cage tests, but caused some injury to plants in the field. At least three applications of arsenicals should be made to fields from which roots are to be transplanted; as much soil as possible should be removed from the roots, and if set out after 10th July, they should be dipped in a suspension of lead arsenate (6 lb. in 50 U.S. gals. water) and allowed to dry before planting.

In August and September 1934, the terminal growth and leaves of peppermint and spearmint in experimental plots were injured by *Plusia* (*Autographa*) *ou*, Gn. The moths emerged in September in the insectary. Two species of parasites were reared, *Litomastix* (*Copidosoma*) *truncatella*, Dalm., from the larvae, and a Tachinid from the pupae.

Other pests on mint include cutworms (which are abundant when the spring is cold and wet) and grasshoppers, against which ploughing in the autumn and a poison bran bait containing 25 lb. bran, 1 lb. Paris green, white arsenic or sodium arsenite, 2 U.S. quarts molasses and 2–3 U.S. gals. water are recommended, wireworms, Lamellicorn larvae. Tipulids [*cf.* **19** 453], various Aphids, including *Phorodon*

menthae, Buckt., and Thysanoptera, thought to be *Thrips tabaci*, Lind., though *T. nigropilosus*, Uzel, has been recorded on mint in Michigan [**17** 558], and *Frankliniella gilmorei*, Morgan, in Tennessee. A list is given of a number of other insects that cause very slight damage to mint or have been taken on it without having been observed to feed.

Brindley (T. A.) & Shipman (H. J.). **Influence of Specific Gravity on the Separation of Weevil-infested Peas.**—*Seed World* 28th February [1936] reprint 2 pp., 3 figs., 2 refs. Chicago [1936].

The method of separating sound peas from those damaged by *Bruchus pisorum*, L., by immersing them in a saturated solution of salt or Chile saltpetre (sodium nitrate) [*R.A.E.*, A **10** 222] has been used in the United States with varying success. Many of the damaged seeds fail to float if the solution is of too low a density and also if the separation is carried out before the cavities made by the Bruchid are large enough to increase appreciably the buoyancy of the infested seeds. Experiments were, therefore, undertaken in Idaho in 1933 and 1934 to determine the relationship of the density of the solution and the stage of development of the Bruchids to the efficiency of the separation. Ripe peas were taken at intervals from a badly infested plot, fumigated to destroy any Bruchids present, and dried. A saturated solution of sodium chloride was used at room temperature in 1933, and 4 solutions of calcium chloride, having higher specific gravities (varying from 1·22 to 1·28), at 59°F. in 1934. Over 99 per cent. of the infested seeds collected on 25th July 1933, when the Bruchids were in the larval stage, sank, as compared with 6 per cent. of those collected when most of the Bruchids were adult. The separation was more efficient in the solutions of higher specific gravity. In a sample taken on 20th July 1934, the percentages of the infested peas that floated were 86·61 and 32·5 in the solutions having specific gravities of 1·28 and 1·22, respectively. The range in the percentages that floated in the different solutions decreased as the Bruchids matured, but the one with the highest specific gravity always removed the highest percentage of infested seeds ; in one case 99·28 per cent. were removed. As the specific gravity of the solution increased, the percentage of sound peas that floated also increased. The greatest loss of sound peas occurred in a sample collected on 27th July, when 13·17 per cent. of the sound peas floated in the solution having a density of 1·28, though all the sound peas sank in the one having a specific gravity of 1·22. Most of the infested seeds that sank were those in which the developing Bruchid had merely penetrated the seed-coat before being destroyed.

Although a more complete separation is obtained with calcium chloride, its hygroscopic properties make it difficult to work with, and if it is not completely removed from the seeds, they become wet and sticky. It was used in the experiments because of the wide range of densities that could be obtained with it, but the densities found most effective can be obtained with magnesium sulphate and potassium nitrate. In one of the several types of separating machines that have been developed, the peas only remain in the solution for 20 seconds, little if any of the salt is absorbed and the seeds are unharmed if washed and dried immediately. It is apparent that the peas must

not be fumigated until most of the Bruchids have become adults. When the peas are processed without being fumigated, care must be taken to prevent any Bruchids escaping and re-infesting the crop.

Hoyer (D. G.) & Leonard (M. D.). **Toxicity of Rotenone Powders.** —*Soap* **12** no. 3 reprint 1 p. New York, March 1936.

The authors point out that since the insecticidal value of cubé [*Lonchocarpus*] and derris roots is greater than is indicated by the amount of rotenone they contain [*cf. R.A.E.*, A **23** 454], percentage total extractives as well as rotenone content alone should be taken into account to obtain an accurate measure of the toxicity of dust prepared from a given sample. They suggest the use of an "Index of Relative Toxicity" which is the figure obtained by dividing the percentage of total ether extractives by the percentage of rotenone.

Painter (R. H.) & Grandfield (C. O.). **Preliminary Report on Resistance of Alfalfa Varieties to Pea Aphids** (*Illinoia pisi* **(Kalt.)).** —*J. Amer. Soc. Agron.* **27** no. 8 pp. 671–674, 1 fig. Geneva, N.Y., August 1935. (Abstr. in *Exp. Sta. Rec.* **74** no. 3 p. 371. Washington D.C., March 1936.)

During 1934, investigations of the resistance of varieties of lucerne to *Macrosiphum onobrychis*, Boy. (*Illinoia pisi*, Kalt.) in Kansas showed that the Ladak variety is much less susceptible to moderate infestations than other common varieties, and when grown under comparable conditions to the latter it was always damaged least. In a 4-year-old plot of 36 varieties, the average percentage of injury varied from 10 for Ladak to 80 for Argentine. Observations on about 500 plants in the nursery rows indicated that the Turkestan group of lucernes were the most resistant to injury by this Aphid.

Hinds (W. E.) & Osterberger (B. A.). **Light Borer Occurrence in 1935.**—*Sugar Bull.* **13** no. 24 pp. 22, 24. (Abstr. in *Exp. Sta. Rec.* **74** no. 3 p. 374. Washington, D.C., March 1936.)

Observations in Louisiana showed that the unusual cold and frosts and the heavy rainfall during the winter of 1934–35 caused a high mortality of the sugar-cane borer [*Diatraea saccharalis*, F.]. The hibernation of the egg-parasite, *Trichogramma minutum*, Riley, was not similarly affected. In 1935, parasitism of the eggs of *D. saccharalis* on maize and sugar-cane was higher than normal and more generally distributed in spite of the small number of egg batches present.

Squire (F. A.). **Recent Entomological Investigations, II.**—*Agric. J. Brit. Guiana* **7** no. 1 pp. 21–26, 2 pls., 3 refs. Georgetown, March 1936.

Evidence of damage to bananas by *Colaspis hypochlora*, Lef., has been observed on one part or another of the coast of British Guiana almost continuously since the outbreak that occurred in 1934 [*R.A.E.*, A **24** 260]. A severe infestation in one locality in January 1936 caused a total loss of crop. Information on the bionomics of this Eumolpid in Colombia [**17** 157] is briefly summarised. The larvae have not been found on any plant in British Guiana, and their breeding ground is unknown. The comparative absence of the pest before

1934 was probably due to the seasonal extremes of climate, which produce alternate floods and drought. Since January 1934, the rainfall has been fairly evenly distributed and prolonged flooding has seldom occurred. Little can be done for control until the breeding grounds of the larvae have been found ; against the adults arsenical sprays proved useless as they were easily washed off by rains.

The most important parasites of *Brassolis sophorae*, L., which is one of the most serious pests of coconut in British Guiana, are *Telenomus nigrocoxalis*, Ashm., which attacks the eggs, and *Brachymeria* (*Chalcis*) *annulata*, F., and *Spilochalcis morleyi*, Ashm. (*brassolis*, Schrottky), which infest the pupae [*cf.* **20** 707 ; **23** 61]. No parasites were found among 876 pupae of the second generation of *Brassolis* collected from coconuts in a village near Georgetown in January 1936, following an outbreak there in August 1935. Of 235 egg-masses collected at the same time, 187 were parasitised. In some of these all the eggs were destroyed, but in a few only about 20 per cent. were attacked.

Briant (A. K.). **Insect Pests and Fungus Diseases.**—*Rep. agric. Dep. St Vincent 1934* pp. 2–3. St Vincent, 1936.

Myers (J. G.). **Report of an Entomological Investigation in St Vincent.**—*Op. cit.* pp. 43–51, 5 refs.

In the first report brief notes are given on miscellaneous pests observed in St. Vincent in 1934. With the exception of *Platyedra gossypiella*, Saund., these are also mentioned in the second, which has already been noticed from another source [*R.A.E.*, A **23** 447]. No damage to cotton by the larvae of *Alabama argillacea*, Hb., was observed during the year.

de Verteuil (L. L.). **Sugar-cane Varieties in Antigua in Relation to (a) Infestation, (b) Field Losses by the Moth Borer** (*Diatraea saccharalis* **Fabr.**).—*Trop. Agriculture* **13** no. 5 pp. 130–135, 3 figs., 9 refs. Trinidad, May 1936.

Experiments on the resistance of different varieties of sugar-cane to *Diatraea saccharalis*, F., were carried out in Antigua. Various types of injury to sugar-cane are described and previous work on varietal susceptibility is reviewed. Each of 2 blocks of land was divided into 32 plots, and (in December 1933 or January 1934) 7 varieties of cane were planted on both blocks, each in 4 plots chosen at random ; although the 4 corner plots were planted the results were not used. The cane was reaped in March 1935, and 10 stools from each plot were examined. The canes were sorted into 4 categories : free from attack ; attacked but still alive ; killed but saleable ; and killed and not saleable. On one block infestation was low, and the varieties showed no significant differences in the effect of borer attack, measured either by the percentage of infested joints or the percentage loss in weight. On the other block the infestation was higher, the percentage of canes killed (whether saleable or not) varied from 12·1 for variety S.C. 12/4 to 29·0 for P.O.J. 2878, the percentage unsaleable varied from 1·5 for B.H. 10/12 to 12·8 for P.O.J. 2878, and over 99 per cent. of the canes of all varieties were bored. Treatment of the results by Fisher's method indicates that P.O.J. 2878 has a significantly greater percentage loss in weight due

to attack than the other varieties, which showed no significant difference among themselves. P.O.J. 2878 also showed a significantly greater percentage of infestation at the joints than all varieties except Ba. 11569, which itself had a significantly greater percentage than B. 2935 and S.C. 12/4, while the remaining varieties showed no differences among themselves. Thus, measuring by the infestation at the joints Ba. 11569 and P.O.J. 2878 are equivalent, but the loss in weight of the latter is considerably greater ; and there is no difference in weight corresponding to the difference of infestation between Ba. 11569 and B. 2935 or S.C. 12/4. It appears that a high percentage infestation at the joints is not necessarily correlated with high material damage.

The losses per acre in these experiments varied from 1·1 tons (P.O.J. 2878) to 0·4 tons (B. 726 and S.C. 12/4) in low infestation, and from 5·7 tons (P.O.J. 2878) to 2·5 tons (B. 726) in the higher infestation.

CHEN (Fong-ge). **Notes on the Scale Insects of *Citrus* in several Districts of East Chekiang, with Description of one new Species.**—*Ent. & Phytopath.* **4** no. 11 pp. 208–228, 8 figs. Hangchow, 11th April 1936.

A list is given of 29 species of Coccids taken on *Citrus* in Chekiang, with notes on their food-plants, natural enemies and distribution in China, and a key to the adult females. They include *Coccus jungi*, sp. n., described from the adult female, and *C. bicruciatus*, Green, and *Cerococcus bryoides*, Mask., and which are recorded for the first time on *Citrus*. The most injurious species is *Icerya purchasi*, Mask., which in some areas almost destroys the *Citrus* orchards, though it is attacked by various predators, including the Coccinellids, *Rodolia rufopilosa*, Muls., and *R. limbata*, Motsch. [*cf. R.A.E.*, A **22** 550].

HSU (T. S.). **Resistance of Sorghum to Stem Borers.**—*J. Amer. Soc. Agron.* **28** no. 4 pp. 271–278, 15 refs. Geneva, N.Y., April 1936.

Experiments on the resistance of *Sorghum* to Lepidopterous stem borers, of which the chief species in North China are *Pyrausta nubilalis*, Hb., and *Diatraea* sp., were carried out at Peiping in 1933 and 1934.

Data obtained in field tests in 1933 from 1,073 varieties and strains showed that the extent of infestation varied with the strain, and in 1934 further trials with the most and least susceptible varieties confirmed this. In both years some association was found between infestation and height (probably because the tall plants present more space for attack), and between infestation and the colour of the grains (or possibly some character associated with it), plants with white grains being most resistant. It appears probable that differences in susceptibility between varieties were due to selection by the ovipositing moths, as plants of any variety were severely injured when larvae were placed on them.

TAKAHASHI (R.). **Hedges in Formosa considered from the Standpoint of Economic Entomology.** [*In Japanese.*]—*J. Soc. trop. Agric.* **8** no. 1 pp. 78–81. Taihoku, March 1936.

A brief account is given of the ecological characteristics of hedges and the insects found on hedge-plants in Formosa.

Gardenia is attacked by some 30 insects, most of which are polyphagous, including some pests of cultivated trees and vegetables. Of about 20 insects found on *Murraya*, *Aulacaspis murrayae*, Takah., sometimes causes serious damage to it. Some pests of *Citrus*, such as *Pulvinaria polygonata*, Ckll., *Lepidosaphes beckii*, Newm., and *Diaphorina citri*, Kuw., also occur on this plant. Over 50 insects attack *Ficus retusa*, and 70 per cent. of these are polyphagous. The 15 insects feeding on *Hibiscus* include such cotton pests as *Phenacoccus hirsutus*, Green, *Aphis gossypii*, Glov., and *Dysdercus cingulatus*, F. (*megalopygus*, Bred.).

Bougainvillaea is entirely free from insects, and *Podocarpus* is only attacked by a few.

Over 50 species are found on bamboos, the majority being Aphids and Coccids. These insects rarely attack other plants, but the ant, *Polyrhachis dives*, F. Smith, which fosters Aphids and Coccids and builds nests on cultivated trees, is abundant in bamboo hedges.

SHIBATA (K.). **Notes on the Autecology of some Fruit-flies. III. On the Velocity and Threshold of Development of the Eggs of** *Chaetodacus ferrugineus dorsalis* **Hendel.** [*In Japanese.*]—*J. Soc. trop. Agric.* **8** no. 1 pp. 95–101. Taihoku, March 1936.

In further experiments on *Dacus* (*Chaetodacus*) *dorsalis*, Hend., in Formosa [*cf. R.A.E.*, A **24** 275], eggs kept at constant temperatures within two hours after being laid hatched at 12°–38°C. [53·6°–100·4°F.), but not at temperatures above or below. The percentages hatching were 79·4 at 16°C. [60·8°F.] and 96·8 at 36°C. [96·8°F.]. The duration of the egg-stage in hours averaged 27·1 at 32°C. [89·6°F.], 29·8 at 30°C. [86°F.], 66·6 at 20°C. [68°F.] and 264 at 12°C. [53·6°F.].

YOSHIDA (K.). **Report of the Studies on the Insect Pests of Vegetables in Formosa 1.** *Epilachna vigintioctopunctata*, **Fab.** [*In Japanese.*] *Bull. Govt Res. Inst. Formosa* no. 117, 28 pp., 1 col. pl. Taihoku, March 1936.

The Coccinellid, *Epilachna vigintioctopunctata*, F., is common in Formosa, where it feeds on egg-plant, tomato, potato, tobacco and wild solanaceous plants, as well as on cucumber, *Cucurbita moschata* and *Luffa cylindrica*. Observations showed that it has 7 generations a year, the overwintered adults becoming active early in March. The life-cycle is completed in 20 days in July and August, but requires over 30 in spring and autumn, the egg, larval, and pupal stages lasting 3–11, 13–34 and 4–12 days, respectively.

The average life of adults is 63·2 days. They pair 4–20 days after emergence and begin to oviposit a few days later, laying 6–78 eggs at a time on the lower surface of the leaves. In the hottest part of the season only about 22 per cent. of the eggs hatch.

No natural enemy has been observed. The beetles are killed by pyrethrum with soap as a spray or with ash as a dust, sprays of derris or nicotine being much less effective.

On *Dialeurodes citri*, **Ashm.** [*In Japanese.*]—*J. Plant. Prot.* **23** no. 4 pp. 58–64, 1 fig. Tokyo, April 1936.

Dialeurodes citri, R. & H., was first observed in the Okayama Prefecture in 1914 and caused serious damage to *Citrus* there in 1930 and

1931. It has two or three generations a year, the adults occurring from mid-May to late June, in late July and August and in September. The winter is passed in the larval stage. In experiments, all the larvae were killed by a lubricating oil emulsion and a high percentage by a spray of resin and sodium hydroxide.

ESAKI (T.) & HASHIMOTO (S.). **Report on the Leafhoppers injurious to the Rice Plant and their Natural Enemies, No. 7 (for the Year 1935).** [*In Japanese.*]—31 pp., 5 pls., 1 fig. Fukuoka, Ent. Lab. Dep. Agric. Kyushu Univ., April 1936.

Jassids and Delphacids were more abundant on rice in Oita, Kyushu, than in the previous year [*R.A.E.*, A **23** 264]; the numbers of the individual species collected by a light trap are shown in graphs.

Nephotettix bipunctatus cincticeps, Uhler, rapidly increased early in August, when 721 females and 238 males were caught in a light trap in a single night. *Sogata furcifera*, Horv., was most abundant in mid-August, and *Deltocephalus dorsalis*, Motsch., towards the end of the month. *Nilaparvata oryzae*, Mats., caused serious damage in some regions of Fukuoka Prefecture early in September. Notes are given on pairing and abnormal colouration in *N. bipunctatus cincticeps*, and the adult and all nymphal instars of *S. furcifera* are described. *Nilaparvata oryzae* was parasitised by the Dryinids, *Ecthrodelphax bicolor*, Esaki & Hashimoto, *Haplogonatopus japonicus*, Esaki & Hashimoto, and *Pseudogonatopus flavifemur*, Esaki & Hashimoto. Of the abnormally coloured males of *N. bipunctatus cincticeps*, 65 per cent. were parasitised by *Pipunculus* [*cf. loc. cit.*]. *Orius* (*Triphleps*) *sauteri*, Popp., was observed feeding on *Erythroneura mori*, Mats., on mulberry and on *Empoasca* (*Chlorita*) *flavescens*, F. The fungus, *Entomophora delphacis* infested *Nilaparvata* and also seemed to attack *Nephotettix*; it was easily cultivated on an artificial medium.

Of 91 individuals of *Nephotettix*, collected in early spring from an area where the rice virus (dwarf disease) had been prevalent and fed on healthy plants, only one transmitted the infection. A single infection was again obtained in experiments with their offspring. Many nymphs, fed on infected plants for 13 or 20 days, transferred the disease to healthy ones.

THORNTON (Sir Edw. N.). **I. The Dangers of the Locust Campaign to Human Beings.**—*Quart. Bull. Hlth Org. L.o.N.* **5** no. 1 pp. 158–159. Geneva, March 1936.

DU TOIT (P. J.) & STEYN (D. G.). **II. The Dangers of the Locust Campaign to Stock.**—*T.c.* pp. 159–160.

The extensive use of sodium arsenite in locust control in South and South-West Africa, where about 3,000 tons were used during the 1933–34 campaign, led to a considerable number of cases of arsenical poisoning in man and to some deaths. Apart from poisoning by contact, most of the cases among the natives were due to the use as water vessels of the tins that had contained locust poison.

There was also a heavy mortality among stock, especially cattle and sheep, 2 gm. sodium arsenite being sufficient to kill an ox weighing 350 kg. [*cf. R.A.E.*, A **22** 381]. Pasture sprayed at the usual rate of 115–120 gals. of a 0·6 per cent. solution of sodium arsenite per acre was dangerous, and where spraying had been intensive subacute

poisoning of stock occurred even after heavy rains, while in some dusted areas pools of rain-water contained dangerous amounts of arsenic.

ZOLOTAREVSKY (B. N.). **Compte-rendu sommaire sur les recherches de la Mission d'Etudes de la Biologie des Acridiens dans la région du Tchad en 1935.**—*Bull. Soc. Hist. nat. Afr. N.* **27** no. 3–4 pp. 108–124, 1 map. Algiers, 1936.

This report deals with the field reconnaissance for locusts in the French Chad Territory carried out in 1935 in the area adjoining Lake Chad, and to the north and east of it as far as the southern foothills of Tibesti, Ennedi Massif and Waddai heights. Particulars of the itinerary and of the climate and vegetation in the areas visited are given ; these belong either to the Sahelian-Steppe or to the South Saharan zone.

The gregarious phase of *Schistocerca gregaria*, Forsk., was not seen anywhere, and the solitary phase was confined to the Mortcha region, to the south-west of Ennedi Massif. It occurred in the sandy bottoms of the water courses where the vegetation was permanently green. All the examples encountered in August–September belonged to the generation that had developed during the current rainy season (July–September). It is concluded that although Mortcha forms a part of the distribution area of *Schistocerca*, swarms cannot arise there under the usual rainfall conditions, for normally only one generation is produced in a year and large numbers of hibernating individuals must perish during the dry season, which lasts ten months [*cf. R.A.E.*, A **24** 232].

Nomadacris septemfasciata, Serv., was not found in the French Territory along the borders of Lake Chad, which are wooded and unsuitable for this species, but numerous individuals were encountered to the north-west of Lake Fitri. The solitary phase of *Locusta migratoria migratorioides*, R. & F., was met with throughout the Sahel zone ; isolated individuals of the gregarious phase of unknown origin were seen in the Borkou region, and numerous swarms in the Waddai and Batha.

FROGGATT (J. L.). **Entomological Notes.**—*New Guinea agric. Gaz.* **2** no. 1 pp. 10–14. Rabaul, January 1936. [Recd. May 1936.]

An account is given of the insects that attack the leaves of coconut in the Territory of New Guinea, other than *Sexava* spp. [*cf. R.A.E.*, A **24** 201]. They are of greater importance than the pests of all other parts of the palm combined. The injury caused and the appearance of some of the stages are briefly described. *Promecotheca papuana*, Csiki (*antiqua*, Ws.) is generally distributed and injurious in some areas. The adults feed on the lower surface of the leaflets and the larvae mine in them. The eggs are laid in clusters of 2–3 (sometimes as many as 5) on the lower surface of the pinnae. The egg and larval stages occupied 11–17 and 17–23 days, respectively, in the insectary, and the prepupal and pupal periods an average of 14 days. The adults, which did not emerge from the mines for several hours, lived for at least six weeks on small palms. As there is no apparent seasonal variation in development, there are probably about 7 generations a year. Infested fronds

should be cut off and burned. Parasites reared were *Anastatus* sp. from the eggs and *Entedon* sp. from the larvae. *Brontispa froggatti*, Sharp, which is also generally distributed throughout the Territory and of which the commonest native food-plant is *Areca* [*catechu*], occurs mostly on coconut palms up to 3 years old. Both adults and larvae attack the surface tissue of the opening leaflets. The egg, larval and pupal stages are passed between the leaflets and last about 4, 22–29 and 6 days, respectively. In the nurseries regular collection of the infested leaflets and treatment with a nicotine wash is effective. Other Hispids attacking coconuts are *Plesispa ruficollis*, Spaeth, and *Oxycephala papuana*, Gestro, which have been collected only in the Manus district, *O. cornigera*, Guér., which is comparatively rare, and *O. wallacei*, Baly, which is more usually a pest of *Pandanus*. The larvae of the Hesperid, *Telicota bambusae*, Moore, which often defoliate young coconut palms, remain concealed during the day between 2 leaflets joined together with threads, and come out to feed at night. The Chalcid, *Brachymeria euploeae*, Westw., and the Ichneumonid, *Echthromorpha insidiator*, Smith, were bred from the pupae. The best method of control is to collect the larvae by hand. The larvae of *Prodenia litura*, F,, also occasionally defoliate young palms, and those of *Decadarchis ophiocypha*, Meyr., damage the opening leaflets of mature ones, generally when they are recovering from infestation by *Sexava*.

Pests of sweet potatoes, which are extensively grown in the Territory, are the Sphingid, *Hippotion celerio*, L., and *Cylas formicarius*, F. The larval stage of *H. celerio* lasts at least 10 days and the pupal 15–18. Infestation is worse in the dry season. Dusts of calcium arsenate or lead arsenate, applied to the lower surface of the foliage as soon as the first evidence of feeding is observed, give effective control. The eggs of *C. formicarius* are deposited in small cavities in the runners and tubers. The larvae hatch in less than a week, tunnel in the tubers, and pupate there or in the runners. As the life-cycle occupies 4–6 weeks in temperate climates, it is probably less in New Guinea. Cuttings from infested plants should not be used, and old tubers and vines should be burned or buried deeply after harvest. Lead arsenate as a dust or spray (1 lb. in 50 gals. water), applied as soon as the weevils appear, gives some control.

FROGGATT (J. L.). **Some Insect Pests recorded from the Mandated Territory of New Guinea.**—*New Guinea agric. Gaz.* **2** no. 1 pp. 15–18. Rabaul, January 1936. [Recd. May 1936.]

A list is given of some 140 insect pests from the Territory of New Guinea, based on identifications received from the Imperial Institute of Entomology, showing the plants they attack.

Service and Regulatory Announcements, October–December, 1935.—*S.R.A. B.P.Q.* no. 125, pp. 71–103. Washington, D.C., U.S. Dep. Agric., March 1936.

Recent revisions and amendments of existing orders of the United States Bureau of Entomology and Plant Quarantine are given verbatim, together with a summary of the domestic and foreign quarantines and other restrictive orders now in force in the United States. Summaries of foreign plant pest legislation include a list of the areas in Greece in which *Phylloxera* does or does not occur on vines.

Ross (H. H.). **A new Pecan Sawfly, *Megaxyela langstoni* n. sp. (Hymenoptera : Xyelidae).**—*Ent. News* **47** no. 5 pp. 131–132. Philadelphia, Pa, May 1936.

Both sexes are described of *Megaxyela langstoni*, sp. n., reared from larvae on pecan in Mississippi. Characters are given distinguishing the adults and larvae of *M. langstoni* from those of *M. major*, Cress., the larvae having been confused. *M. major* appears to be a solitary feeder on pecan and some other hickories, whereas *M. langstoni* is gregarious.

[Bissell (T. L.).] **Entomology.**—*Rep. Ga Exp. Sta.* **47** (1934–35) pp. 24–30, 2 figs. Experiment, Ga, 1935. [Recd. May 1936.]

An account is given of work on insect pests carried out in the State of Georgia during 1934 and 1935.

About mid-March in both years the adults of *Diabrotica duodecimpunctata*, F. (corn budworm), appeared in numbers on rye and wild plum and peach blossom. The larvae cause greater injury to maize grown after winter cover crops of green manure than to that grown without winter crops, but severe injury also occurred on ground that had been bare during the winter. Pot experiments showed that second instar and small third instar larvae caused the greatest damage. In 1935, the larvae attacked soy beans grown after a crop of winter peas, feeding on the cotyledons and roots so that 10 per cent. of the plants failed to come up.

Studies on the bionomics and control of Buprestids boring in pecan wood, chiefly *Chrysobothris femorata*, Ol., carried out by means of 100 posts on which grease was spread in April and again in July, showed that the adults were active from mid-April to mid-October, and particularly between mid-May and mid-July. The peak of emergence (from infested wood in cages) was from June to mid-July. Since 1933, tests have been made on nearly 400 pecan trees in heavily infested orchards, to find some material to repel the borers. The trees, which were 1, 2 and 8–12 years old, were examined twice before treatment, and all borers removed as they were found, but there was some difficulty in making certain that the trees were uninfested ; mixtures of soap and naphthalene were then painted on several times during each season, or the trunks were kept wrapped in cloth or paper from spring to winter. The trees were re-examined at the end of each season. None of the materials was effective on the larger trees. One season's work using unbleached cotton cloth (either 2·85 or 4·8 yds. to the lb.) or butcher's paper on the younger trees gave good results. The percentages of trees infested were 0·0, 0·0, and 4·5, compared with 30·8 for the control trees. Three other Buprestids were bred from pecan wood in small numbers, *Actenodes acornis*, Say, which was the most numerous and appeared from mid-May till late August, *Chrysobothris chrysoela*, Ill., and *Acmaeodera tubulus* F. Infestation of pecan nuts by the pecan weevil [*Curculio caryae*, Horn] was not reduced by the application of poison bait sprays containing 1 per cent. tartar emetic with the addition of cane sugar, molasses or Syrline (a commercial invert sugar) to give 5 per cent. sugar content. In July, 4·3 per cent. of the crop on the trees was infested. Jarring the trees twice a week during August and September gave no better results than jarring once a week. Weevils punctured the nuts from late June to late September, but most of the injury was done in late August and early September.

Other insect pests that occurred in Georgia during the year included : *Listroderes costirostris*, Schönh. (*obliquus*, Gyll.), found in the adult stage on potatoes, turnips and cabbages ; *Lachnosterna* (*Phyllophaga*) sp., the adults of which destroyed the new leaves and shoots of pecan so that no nuts were formed ; *Euetheola rugiceps*, Lec., on maize ; and *Psara* (*Pachyzancla*) *periusalis*, Wlk., on tomato and egg-plant.

Roebuck (A.). **A Survey of the Crop Pests of Nottinghamshire during 1935.**—9 pp. Nottingham, Notts. Educ. Comm. [1936.]

This report, which is the first of a proposed series, gives an account of the insect pests occurring in Nottinghamshire, chiefly during 1935. An association of an insect with a fungous disease was observed early in the year ; many crops of clover suffered from clover sickness and in all cases larvae of *Sitona lineata*, L., were found at the roots. *Brevicoryne brassicae*, L., infested most cruciferous vegetables and root crops. This Aphid usually passes the winter in the egg stage on the stumps of the cruciferous food-plants, the eggs hatching about the end of March. If the weather is mild, however, the parthenogenetic forms may survive the winter. All stumps and tops should be destroyed or buried, and if Aphids are present in May or June, the plants should be sprayed or dusted with an insecticide. Later the Aphids are too numerous and the crops too advanced for effective treatment. The most noteworthy of the less usual orchard pests was *Zeuzera pyrina*, L., the larvae of which bored in the branches of pears and other trees in various parts of the county. In one orchard well grown apple trees were severely infested, and many branches were killed.

Jary (S. G.). **The Hypopial Stage of *Aleurobius farinae* Koch (Tyroglyphidae).**—*Ann. Mag. nat. Hist.* (10) **17** no. 101 pp. 546–552, 1 fig. London, May 1936.

Newstead & Duvall [*R.A.E.*, A **7** 91] described the hypopial stage of *Tyroglyphus* (*Aleurobius*) *farinae*, DeG., which does not appear to have been previously recognised. A. D. Michael (1901) stated that he had never found the hypopus of *T. farinae*, but described and figured a hypopus that he associated with *T. dimidiatus*, Herm. (*longior*, Gerv.), and Newstead & Morris [**9** 10] later figured a hypopus that they stated to be that of *T. dimidiatus*. In the author's opinion all these hypopi are actually the hypopial form of *T. farinae*.

Samples of débris, including particles of grain, obtained in March 1935 from under mangers and round posts in a stable in Norfolk, were found to contain numerous mites, among which *T. dimidiatus* and *T. farinae* were well represented. In June, when the samples had become drier, hundreds of hypopi were found in some of them, corresponding with those described by Michael as *T. dimidiatus*. Nymphs and finally adults of both sexes were obtained from these hypopi when placed singly in glass cells, and all were undoubtedly *T. farinae*. A detailed description of the hypopial stage of *T. farinae* is given, together with records of breeding in the glass cells.

Nixon (G. E. J.). **New parasitic Hymenoptera from Africa (Proctotrupoidea Subfam. Telenominae).**—*Ann. Mag. nat. Hist.* (10) **17** no. 101 pp. 558–564, 3 figs., 2 refs. London, May 1936.

The new parasites described are *Microphanurus lemoleae*, bred from eggs of a Lycaenid, ? *Spalgis lemolea*, Druce, on coffee berries, and

Telenomus demodoci, from eggs of *Papilio demodocus*, Esp., both in Uganda ; and *T. ullyetti*, from eggs of *Heliothis armigera*, Hb. (*obsoleta*, F.) on beans in South Africa.

Trouvelot [B.], Grison (—) & Dixmeras (—). **Remarques sur les différences d'attaque par le doryphore de variétés courantes de pommes de terre.**—*C. R. Acad. Agric. Fr.* **22** no. 13 pp. 513–517, 1 ref. Paris, 1936.

From observations in France and enquiries among growers it was found that the degree to which potato plants are attacked by *Leptinotarsa decemlineata*, Say, varies with their stage of growth at the time of the spring migration and oviposition of the beetles. These concentrate and oviposit chiefly on plants at least 6 inches high and not more than 20 days old. Differences in infestation often seen in the field among common varieties of potato are mainly due to planting at different dates and to the different rates of growth of the varieties. According to environment or circumstances, maximum injury by the larvae may occur on early, average or late varieties. Where the average varieties have only just begun to sprout at the period of spring migration and oviposition, early varieties will be most severely attacked, and where the average varieties are well-advanced (12–20 inches high) at this period, the late varieties will suffer most. In the Limousin district the semi-early varieties are most attacked, but each climatic region of France would be subject to a different classification.

Judenko (E.). **Przyczynek do poznania biologji i zwalczania mszycy chmielowej (*Phorodon humuli* Schr.) (Doniesienie tymczasowe).** [A Contribution to the Knowledge of the Biology and Control of the Hop Leaf Aphid, *P. humuli* (Preliminary Communication).] —*Roczn. Ochr. Rośl.* **3** reprint 10 pp. Warsaw, 1936. (With a Summary in German.)

In 1935 *Phorodon humuli*, Schr., was observed at Pulawy, Poland, on plum (*Prunus domestica*) and sloe (*P. spinosa*) from spring to mid-August. On hops, winged forms were abundant throughout almost the whole of June, but were not found among the numerous exules during July and most of August. The migration of the gynoparae and males from hops to plum and sloe occurred in 1934 and 1935 from about 10th September to early November. Oviposition on plum and sloe was observed in these years from mid-October to mid-November. Sloes should be cut down in the period between December and May, but should not be eradicated as the Aphids oviposit in subsequent years on the new shoots, which serve as traps. Plums growing near hop-fields should be treated in winter with a tar distillate to destroy the eggs, or the Aphids that hatch on them should be killed with a contact spray in spring.

To prevent migration to plums and sloes, the leaves of the hops should be removed and used for fodder or destroyed as soon as possible after the hops are picked. Wild hops should be cut before the end of August, but not until the winged Aphids that have migrated to them are dead or these will migrate again to cultivated hops. In experimental work a spray of 0·5 per cent. lysol and 2·5 per cent. soft soap produced nearly 100 per cent. mortality without apparent injury to the hop plants.

Dowson (V. H. W.). **Notes on Insecticide Trials with Date Palms, Kut as-Sayyid Estate, 1934.**—*Hadar* **8** no. 6 pp. 174–175. Jaffa, June 1935. [Recd. June 1936.]

An account is given of experiments carried out at Basrah in 1934 for the control of *Paratetranychus* (*Oligonychus*) sp. (? *simplex*, Banks), *Batrachedra amydraula*, Meyr. (lesser date moth) and *Arenipses sabella*, Hmps. (greater date moth) on date palms. Of these the mite is the most injurious. In 1934 it was present between 4th April and 2nd September, and the larvae of *B. amydraula* and *A. sabella* were observed from 19th April to 23rd July, and 3rd April to 16th May, respectively. The 29 insecticides tested contained as their main constituent either sulphur, lime-sulphur, selenium, petroleum, derris, pyrethrum, nicotine, sodium hydroxide or derris and sulphur combined. These were applied to trees of about 8 years old at the rate of 1 gal. per tree for sprays and ½–8 oz. per tree for dusts. The results are shown in a table. The only materials that destroyed all the mites with one application were 2 high-grade sulphur dusts applied on 14th and 16th July, respectively. Past experience and the tests have shown that, in general, sulphur controls the mites only if applied when the webs first become visible and again about a month later. In a few cases 3 applications were necessary. As the time of application of the insecticide is very important, the failure of any particular one in the tests may have been due to the fact that it was given at the wrong time. No significant difference was observed between the coarser undiluted sulphur dusts and the fine proprietary ones containing anti-balling materials. Derris (dust or spray) did not control the mite. No treatment controlled *B. amydraula* completely, but a petroleum oil emulsion applied on 11th April was the most effective. Against *A. sabella* this oil emulsion and a wash of sodium hydroxide and kerosene, applied on the 11th and 12th April, respectively, before the spathes opened, gave complete control.

Papers noticed by Title only.

Hoyer (D. G.). **Effects of Sunlight on Fly Sprays. A Study of Sunlight Effects on odorless and regular Pyrethrum Liquid Insecticides.** —*Soap* **11** no. 12 reprint 4 pp., 3 charts, 15 refs. New York, December 1935. [Recd. May 1936.] [See *R.A.E.*, B 150.]

Hoyer (D. G.). **Effect of Metals on Fly Sprays. A Study of the Effects of Metals and other Container Materials on Pyrethrum Liquid Insecticides.**—*Soap* **12** no. 1 reprint 2 pp. New York, January 1936. [Recd. May 1936.] [See *R.A.E.*, B 151.]

[Shpet (G. I.). **Шпет (Г. И.). Zur Phänogenetik der systematischen Unterschiede bei Geradflüglern.** [Ontogenetic Analysis of systematic Differences in Orthoptera; *Locusta migratoria*, L., *Dociostaurus maroccanus*, Thnbg., *Chorthippus* spp.] [*In Russian.*] —*Zool. Zh.* **14** no. 4 pp. 674–700, 18 refs. Moscow, 1935. (With a Summary in German.)

Uvarov (B. P.). **La lutte contre les locustes. Pour une politique antiacridienne rationnelle.**—*Bull. agric. Congo belge* **27** no. 1 pp. 106–110. Brussels, March 1936. [Translation: see *R.A.E.*, A **23** 502.]

Eidmann (H.). **Das *Atta*-Problem. Untersuchungen über die Biologie und wirtschaftliche Bedeutung der Blattschneiderameise *Atta sexdens*, L.** [Investigations on the Biology and Economic Importance of the Leaf-cutting Ant, *A. sexdens*, in Brazil.]—*Naturwissenschaften* **24** no. 17 pp. 257–266, 5 figs., 2 refs. Berlin, 24th April 1936. [*Cf. R.A.E.*, A **23** 750.]

Eidmann (H.). **Oekologisch-Faunistische Studien an südbrasilianischen Ameisen.** [Ecological and faunistic Studies on South Brazilian Ants.]—*Arb. physiol. angew. Ent. Berl.* **3** nos. 1–2 pp. 26–48, 81–114, 1 pl., 5 figs., 33 refs. Berlin, 18th March & 4th May 1936.

Lindinger (L.). **Ueber einige Schildläuse des Berliner botanischen Gartens (Coccidae).** [On some Coccids of the Berlin Botanical Gardens; with synonymy.]—*Arb. physiol. angew. Ent. Berl.* **3** no. 2 pp. 153–155. Berlin, 4th May 1936.

Mamet (R.). **New Species of Coccidae (Hemipt. Homopt.) from Mauritius.**—*Proc. R. ent. Soc. Lond.* (B) **5** pt. 5 pp. 90–96, 6 figs. London, 15th May 1936.

Takahashi (R.). **Aphids of the Genus *Astegopteryx* Karsch, with Descriptions of new Species from Sumatra and Formosa (Aphididae, Hemiptera).** [With a key to the species of the genus.]—*Proc. R. ent. Soc. Lond.* (B) **5** pt. 5 pp. 96–102, 1 fig. London, 15th May 1936.

Hottes (F. C.). **A Primer for the Aphid Hunter.**—*Proc. biol. Soc. Wash.* **49** no. 6 pp. 27–36. Washington, D.C., 9th March 1936.

Hood (J. D.). *Frankliniella gossypiana*, **New Name** [for *Euthrips gossypii*, Morg. nec Shiraki].—*Proc. biol. Soc. Wash.* **49** no. 14 p. 68. Washington, D.C., 1st May 1936.

Lysaght (A. M.). **A Note on an unidentified Fungus in the Body Cavity of two Thysanopterous Insects** [*Aptinothrips rufus*, Gmel., and *Limothrips cerealium*, Hal., in Britain].—*Parasitology* **28** no. 2 pp. 293–294, 1 fig., 6 refs. Cambridge, March 1936.

Fidler (J. H.). **Some Notes on the Morphology of the immature Stages of some British Chafer Beetles** [particularly *Melolontha melolontha*, L., *Amphimallus solstitialis*, L., and *Serica brunnea*, L.].—*Ann. appl. Biol.* **23** no. 1 pp. 114–132, 7 figs., 12 refs. Cambridge, February 1936.

Pemberton (C. E.). **Recent Control Measures against *Anomala orientalis* Waterh.** [on sugar-cane in Hawaii].—*Proc. int. Soc. Sug. Cane Tech. 5 Brisbane 1935* pp. 591–593. Brisbane, 1936. [*Cf. R.A.E.*, A **23** 219, 341, etc.]

Barber (H. S.). **A new Ecuadorian Fleabeetle [*Disonycha camposi*] injuring Crucifers (Coleoptera : Chrysomelidae).**—*J. Wash. Acad. Sci.* **26** no. 4 pp. 181–182. Menasha, Wis., 15th April 1936.

Bruck (C. R.). **New Scolytidae (Coleoptera) of Southern California with a key to the species of *Pseudothysanoes* Blackman.**—*Bull. S. Calif. Acad. Sci.* **35** pt. 1 pp. 30–38. Los Angeles, Calif., 1936.

Bruck (C. R.). **A synoptic Revision of the Subfamily Hylesininae (Scolytidae-Coleoptera) of western North America north of Mexico.** —*Bull. S. Calif. Acad. Sci.* **35** pt. 1 pp. 38–51, 8 pls. Los Angeles, Calif., 1936.

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AGRICULTURAL NEWS (BARBADOS) : Nos. 1, 25, 26, 34, 66 (1902–04).

ANNALS OF THE QUEENSLAND MUSEUM (BRISBANE) : Nos. 1, 5 and 6 (1891–).

ANNUAIRE ET MÉMOIRES DU COMITÉ D'ÉTUDES HISTORIQUES ET SCIENTIFIQUES DE L'AFRIQUE OCCIDENTALE FRANÇAISE (GORÉE) : Vols. I–II (1916–17).

ARCHIVES DE L'INSTITUT PASTEUR DE TUNIS :
1906–09 ; 1910, fasc. i–iii ; 1911, fasc. iii–iv.

ARCHIV FÜR SCHIFFS- UND TROPEN-HYGIENE (LEIPZIG) :
Bd. XVII (1913). Hefte, 9, 13 & 14.

ARQUIVOS DO INSTITUTO BACTERIOLOGICO CAMARA PESTANA (LISBON) :
Vols. I–II (1906–10). Vol. III No. 1 (1911)

THE BEE WORLD (BENSON, OXON) : Vols. I–II (1919–21).

BIOLOGICAL BULLETIN OF THE MARINE BIOLOGICAL LABORATORY (WOODS HOLE, Mass.) :
Vols. I–II (1899–1901) ; XXIII (1912) ; XXIV (1912) No. 2 ; XXV (1913) Nos. 5–6; XXVI (1914) Nos. 1–2 ; XXVII (1914) No. 4 ; XXVIII (1915) No. 1 ; XXIX (1915) No. 5 ; XXX (1916) Nos. 2–3 ; XXXI (1916) Nos. 4 & 6 ; XXXII–XXXIII (1917) ; XXXIV (1918) Nos. 1–4, & 6 ; XXXV (1918) ; XXXVI (1919) Nos. 2–3 ; XXXVII (1919) Nos. 4 & 6 ; XXXVIII (1920) Nos. 1, 2, 5 & 6 ; XXXIX (1920) Nos. 4–6 ; XL (1921) Nos. 1–4, & 6 ; XLI (1921) Nos. 2 & 3 ; XLII (1922) Nos. 1–3.

BOLETIN DE LA DIRECCION DE ESTUDIOS BIOLOGICAS (MEXICO) :
TOMOS I–II (1924–25).

BULLETIN AGRICOLE DE L'ALGÉRIE—TUNISIE—MAROC (ALGIERS) :
Année XX (1914). Nos. 7–9, 12–14 and Title-page.

BULLETIN DU COMITÉ D'ETUDES HISTORIQUES ET SCIENTIFIQUES DE L'AFRIQUE OCCIDENTALE FRANÇAISE (PARIS) : Année 1919, No. 1.

CALIFORNIA AGRICULTURAL EXPERIMENT STATION (BERKELEY, CAL.) :
Circulars 14 and 42 (1905–09).

CANADA : DEPARTMENT OF AGRICULTURE : EXPERIMENTAL FARMS :
Fletcher (J.). Reports of the Entomologist and Botanist for the Years 1886 and 1888 (Ottawa, 1887–89).

CHACARAS E QUINTAES (SÃO PAULO) : Indices to Vols. X, XI, XII and XIV; XLII, No. 3.

COMPTES RENDUS DES SÉANCES DE L'ACADÉMIE D'AGRICULTURE DE FRANCE (PARIS) : Tome VIII (1922) No. 5.

EGATEA, REVISTA DA ESCOLA DE ENGENHARIA DE PORTO ALEGRE, BRAZIL :
Vols. I–VI (1916–21) ; VII (1922) Nos. 1–5 ; VIII (1923) Nos. 2–5 ; IX (1924) Nos. 1, 4–6.

ENTOMOLOGICA AMERICANA (BROOKLYN, N.Y.) :
Vol. IV (1888) Title-page. Vol. V (1889) Nos. 6 & 8.

ENTOMOLOGISCHE LITTERATURBLÄTTER (BERLIN) : 6 Jahrg. (1906). Nos. 2 & 10.

EXPERIMENT STATION RECORD (WASHINGTON, D.C.) : Vols. I–IV (1889–94).

GEORGIA STATE BOARD OF ENTOMOLOGY (ATLANTA) :
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LIBRARY LACUNAE—*cont.*

GRASSI (B.) et al. Contributo alla conoscenza delle Filloserine ed in particolare della Fillossera della Vite (Rome, 1912).

INDIA : FOREST RESEARCH INSTITUTE (DEHRA DUN).
Forest Bulletin (Old Series) : Nos. 1–3.
Forest Leaflet (Zoology Series) : Nos. 1–2.

INDIAN MEDICAL GAZETTE (CALCUTTA) :
Vol. L (1915) No. 10 ; LI (1916) Nos. 1–7, 10 ; LII (1917) No. 7 and title-page & index ; LIII (1918) ; and LIV (1919) No. 2.

INDIANA : Third Annual Report of the State Entomologist, 1909–10.

JOURNAL OF THE BOARD OF AGRICULTURE OF BRITISH GUIANA (DEMERARA) : Vol. III No. 1 (1909). Title pp. and Indices to Vols. I–II.

JOURNAL OF THE SOUTH-EASTERN AGRICULTURAL COLLEGE (WYE, KENT) : Nos. 1–6, 8, 11–13 (1895–1904).

KENTUCKY AGRICULTURAL EXPERIMENT STATION (LEXINGTON, Ky.) :
Bulletin Nos. 21 (1889), 31 (1890), 47 (1893), 53 (1894), 74 (1898) and 91 (1901).

THE KENYA AND EAST AFRICAN MEDICAL JOURNAL (NAIROBI) : Vol. II, Nos. 2–3 (1925).

NATUURHISTORISCH MAANDBLAD (MAASTRICHT) : Jaarg 1 (1912) ; II (1913) Nos. 1–4, 6–9 ; V (1916) Nos. 3–4 ; VII (1918) Nos. 6–9 ; VIII (1919) No. 4.

NEW JERSEY STATE DEPARTMENT OF AGRICULTURE (TRENTON, N.J.) : Bulletin 2 ; Circular : 2, 12, 29 (1917–19).

NEW YORK STATE MUSEUM (ALBANY, N.Y.) : Bulletin : 26 & 57 (1899–1902).

ONTARIO ENTOMOLOGICAL SOCIETY REPORT (TORONTO) : 9th (1878).

ORMEROD (E. A.). OBSERVATIONS OF INJURIOUS INSECTS AND COMMON FARM PESTS DURING THE YEARS 1877 & 1878 (London, 1878–79).

PARASITOLOGY. Vol. VI, Nos. 1–3. Vol. IX, No. 1 (Cambridge, 1913–16).

PHILIPPINE AGRICULTURIST AND FORESTER (MANILA) :
Vols. II, Nos. 1–3 (1912) ; III, Nos. 1, 2 (1914) ; IV, No. 4 (1915).

PHILIPPINE JOURNAL OF SCIENCE (MANILA) : Vol. I (1906). No. 10.

PORTO RICO DEPARTMENT OF AGRICULTURE, &C. (SAN JUAN) :
Journal, Vol. I (1917) No. 3.

PSYCHE (BOSTON, MASS.) : Vols. XI (1904), XIII (1906), XVI (1909).

RECORDS OF THE EGYPTIAN GOVERNMENT SCHOOL OF MEDICINE (CAIRO) : Vol. I.

REVISTA DE AGRICULTURA DE PUERTO RICO (SAN JUAN) :
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LA REVUE DE PHYTOPATHOLOGIE APPLIQUÉE (PARIS) : Tome I. Nos. 22–23 (April-May, 1914).

RHODESIA AGRICULTURAL JOURNAL (SALISBURY) :
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RIVISTA DI PATOLOGIA VEGETALE (FLORENCE) : Vols. VII–X (1899–1904).

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